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Interactive Effects of Feedback Type and Feedback Propensities on Task Performance

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INTERACTIVE EFFECTS OF FEEDBACK TYPE AND FEEDBACK PROPENSITIES ON TASK PERFORMANCE

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Kristin M. Delgado ENTITLED Interactive Effects of Feedback Type and Feedback Propensities on Task Performance BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science.

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ABSTRACT

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The purpose of the present study was to examine the effects of feedback types (i.e., outcome, process, and task feedback), feedback propensities, and their interactions on task performance in an attempt to determine, first, which types of feedback produced better task performance and, second, how feedback propensities influenced relationships between feedback type and performance. Process feedback and task feedback were expected to interact in their effects on task performance. In addition, I predicted that external feedback propensity would moderate the effects of process feedback on performance and initial task performance would moderate the effects of internal feedback propensity on task performance. However, none of the hypotheses were directly supported. Overall, the current study demonstrated support for the proposition that feedback does not consistently improve performance. Instead, findings showed that feedback has highly variable effects on performance. Task feedback improved performance, process feedback did not affect performance, and outcome feedback seemed to debilitate performance over time.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Figure Page

LIST OF TABLES

Table Page

Introduction

The concept of performance feedback has received substantial attention in the organizational science literature due to its effects on numerous organizational outcomes. More specifically, performance feedback is important to the design of training programs to ensure training effectiveness (Tannenbaum & Yukl, 1992). However, the role of performance feedback in skill acquisition is not clear in feedback research (Kluger & DeNisi, 1996). For example, different types of feedback may facilitate or impede the skill acquisition process. Specifically, outcome, process, and task feedback may influence skill acquisition differently, having beneficial or detrimental effects, depending on the task conditions. Given that organizations are often encouraged to provide individuals with multiple sources of feedback (Tannenbaum & Yukl, 1992), it is important to consider the joint effects of different feedback types on performance by examining internally-mediated (e.g., task feedback) and externally mediated feedback (e.g., outcome and process feedback). Finally, it is important to consider how personality variables affect individuals' interpretations, processing, and responses to feedback (Herold & Fedor, 1998). In particular, domain-specific individual differences can be applied more readily to specific situations and may provide more predictive power than global personality variables. Specifically, internal and external feedback propensities have been identified as important individual difference variables in the feedback process (Herold, Parsons, & Rensvold, 1996).

Since early behaviorism research in the 1940's, feedback has been examined as a means to facilitate behavior change and enhance performance (Ammons, 1956; Arps, 1920). Much of the feedback literature has focused on feedback effects on performance

(e.g., Vroom, 1964), recipient responses to feedback (e.g., Fedor, 1991; Ilgen, Fisher, & Taylor, 1979; Taylor, Fisher, & Ilgen, 1984), and feedback-seeking behavior (e.g., Ashford & Cummings, 1983; Williams, Steelman, Miller, & Levy, 1998). Despite a considerable body of research, a recent review by Kluger and DeNisi (1996) criticized the current state of feedback research, calling for further research that explains *how* feedback affects performance. Kluger and DeNisi (1996) attributed this deficit to an apparent lack of understanding regarding the underlying processes of feedback effects on performance.

Prior research has proposed that feedback affects performance through increased learning and/or motivation (Ammons, 1956; Vroom, 1964); therefore, feedback can provide information and/or enhance motivation (Salmoni, Schmidt, & Walter, 1984). Substantial literature has focused on the motivational function of feedback. For example, in the context of goal setting, feedback is considered a necessary but not sufficient condition for effective goal setting (Locke & Latham, 1990). However, less research has focused on the informational function of feedback. Some researchers have suggested that feedback facilitates learning through error detection and correction (Goodman, 1998; Salmoni et al., 1979), self-monitoring (Stone, 2003), and directing attentional resources to the task (Kluger & DeNisi, 1996). However, different types of feedback may have differential effects on performance and may affect performance through different mechanisms. Thus, the proposed study will examine the effects of three different types of feedback (i.e., task, outcome, and process feedback) on performance across trials on a novel task.

External Feedback: Process and Outcome

Two types of external feedback distinguished by information content are outcome feedback and process feedback (Earley et al., 1990; Nadler, 1979). Outcome feedback refers to the results or outcomes of the performance effort (Earley et al., 1990). Outcome feedback often is presented as a performance score or level of success or failure, limiting the information value of the feedback to the end-result of the performance effort. Process feedback refers to information about the processes used to achieve the end-result (Earley et al., 1990). Process feedback can include information about strategies, policies, and skills employed during the performance effort.

Existing theory holds that the feedback message content, or the information provided by the feedback message, is a key factor in influencing how the recipient will respond to the feedback (Fedor, 1991; Ilgen et al., 1979). Because outcome and process feedback contain different types of information, the resulting effects of the two types of feedback on performance may vary.

Problems with outcome feedback. There is some evidence suggesting outcome feedback may not be beneficial under certain task conditions, particularly when the task is novel and complex. Earley et al. (1990) found that individuals receiving only outcome performance feedback continued to report high confidence despite poor performance, suggesting that providing outcome feedback alone may give a false sense of confidence. Tindale (1989) also found that outcome feedback contributed to overconfidence. Thus, individuals receiving outcome feedback may continue to use dysfunctional or suboptimal task strategies because they are not receiving any feedback regarding the efficiency of their current strategy. In the presence of outcome feedback that only provides

information about the solution quality, individuals may assume they possess enough information to perform the task and simply cease further search for additional information.

Researchers have suggested that outcome feedback is less effective for learning because its presence does not facilitate the search for additional information. Fedor (1991) suggested the presence of outcome feedback might lead to less processing because outcome feedback may signal that there is no need for additional information, especially in complex tasks (Hammond, Summers, & Deane, 1973). In addition, because outcome feedback emphasizes the end-result, it may cue individuals to focus on proving competence rather than increasing competence or achieving mastery of the task (Johnson, Perlow, & Pieper, 1993). Instead of directing efforts at improving skills, individuals will be interested in merely demonstrating proficiency. Similarly, because outcome feedback emphasizes performance outcomes, it may divert attentional resources away from the task and direct attention toward the self (Kluger & DiNisi, 1996). Instead of focusing on the task, individuals may focus on evaluation of their performance or other goals (e.g., making a good impression). Consequently, outcome feedback may not be beneficial in a complex, dynamic task environment, resulting in debilitating effects on learning and subsequent performance (Jacoby, Troutman, & Kuss, 1984).

Potential value of process feedback. Due to the ineffectiveness of outcome feedback for learning during multiple-cue probability tasks, researchers have used alternative types of feedback (Balzer, Doherty, & O'Connor, 1989), such as cognitive feedback, which refers to relationships between cues and criteria, inferences, and distal objects (Doherty & Balzer, 1988). Many empirical studies have compared outcome

feedback to cognitive feedback Although a full explanation of cognitive feedback is beyond the scope of this paper, the differential effects of cognitive feedback versus outcome feedback on performance have been examined extensively in human judgment research (e.g., Adelman, 1981; Hammond, Stewart, Brehmer, & Steinmann 1975). Developed from Social Judgment Theory, cognitive feedback provides information that serves as a performance index that conveys to individuals reasons why they performed the task in a particular way or how they chose a particular strategy (Hammond, McClelland, & Mumpower, 1980). Researchers have found that cognitive feedback improved performance on complex tasks (Balzer et al., 1989) and resulted in increased cognitive control, or the ability to apply knowledge with sufficient consistency (Adelman, 1981).

However, cognitive feedback is generally presented as mathematical weights of various environmental cues and function forms, which is quite different from the presentation of process feedback that is usually presented in a statement form. As such, cognitive feedback may be extremely resource intensive for organizations, making it unreasonable or implausible for use in all situations. Cognitive feedback may be cumbersome and time-consuming for those providing feedback, and feedback recipients may require training to understand and use the cognitive feedback information. Process feedback is similar to cognitive feedback in that it is focused on what task strategies are used (Balzer, Doherty, & O'Connor, 1989) but is less complex and easier to provide.

Process feedback, defined as information on how an individual implements a work strategy, may have a better effect on performance and learning on complex tasks than outcome feedback (e.g., Korsgaard & Diddams, 1996; Lam & Schaubroek, 1999),

but these effects have not been studied as extensively as the effects of cognitive feedback compared to outcome feedback. More empirical evidence regarding the provision of process feedback is needed in order to draw strong inferences about the effects of process feedback on performance. Although researchers have proposed various mechanisms, how process feedback leads to better performance is not clear. Korsgaard and Diddams (1996) suggested the provision of process feedback influenced individuals' propensity to set multiple goals and to use more focused information-search strategies. Earley et al. (1990) found that feedback appropriateness, information search, and task-strategy quality mediated the effects of process feedback on performance. Thus, process feedback may lead to less feedback-related uncertainty, deeper processing of the information, and increased attention to the feedback content, resulting in increased strategy assessment and development (Fedor, 1991). Earley et al. (1990) proposed that process feedback serves as a cueing device for strategy implementation. In their Feedback Intervention model, Kluger and DeNisi (1996) suggested that directing attentional resources to the task processes results in enhanced performance and learning. While previous research has shown that process feedback may lead improved strategy assessment and development, the effects of process feedback on performance are not clear.

If process feedback directs attention to the task, it should also cue individuals to focus on improving competence rather than demonstrating a particular level of proficiency, which diverts resources to off-task, evaluative activities that often results from the provision of outcome feedback. Instead, process feedback encourages individuals to devote their attentional resources to understanding and performing the task. Therefore, individuals will concentrate on developing skill and task mastery, resulting in

improved performance at initial skill acquisition. Thus, I propose process feedback will provide more task-relevant information, direct more attentional resources to strategy development and implementation, and encourage individuals to focus on improving competence, or task mastery. Process feedback is more task-focused, involving evaluation of performance standards and behaviors employed, and it directs cognitive efforts toward methods of improving task performance. Therefore, process feedback will direct attention to task-relevant cues, facilitating effective strategy development, which in turn, enhances performance.

Internal Feedback: Task Feedback

Researchers have identified the task environment as an important source of feedback (Greller & Herold, 1975). Task feedback is feedback provided by the task environment (Ilgen et al., 1979). Task feedback can be characterized as changes in the task conditions that indicate process during task execution and is distinct from the types of external process and outcome feedback discussed previously, such that performance information is derived from the task itself.

The feedback literature has frequently addressed the role of the feedback source as a factor in how feedback affects performance (Greller & Herold, 1975, 1977; Ilgen et al., 1979). In general, researchers have found that feedback source is related to the credibility, trustworthiness, and resulting acceptance of the feedback, which are all factors thought to influence the effect of feedback on recipient behavior (Ilgen et al., 1979). Ilgen et al. (1979) have identified three main sources of feedback: feedback from others (e.g., external feedback), from the task environment, and from the self. In contrast, Herold and Greller (1975) identified five potential sources of feedback: the

formal organization, supervisor, co-workers, task, and self. However, both categorizations of feedback sources can be arranged on a continuum of internal to external feedback sources, with feedback from the task and self on the internal end and feedback from co-workers, supervisors, and the organization on the external end. Greller and Herold (1975, 1977) found that individuals relied upon feedback from the task and from themselves more than feedback from external sources. From these findings, Ilgen at al. (1979) concluded that individuals pay closer attention to feedback from sources that are psychologically closer (i.e., self and the task).

Also important is how accurately the recipient perceives the feedback message. It is important for individuals to perceive feedback messages accurately in order for feedback to influence performance. Otherwise, individuals may misunderstand or misinterpret the feedback message, impairing subsequent performance. Because individuals report more attention to feedback sources that are psychologically closer, they may perceive feedback from psychologically closer sources with more accuracy. To the extent that task feedback is perceived as close in the psychological sense, recipients should perceive information provided by task feedback accurately.

However, task feedback may not provide as much useful information as feedback from external sources under certain circumstances, particularly during initial skill acquisition of a complex task. External feedback, such as the process information described previously, can give the individual additional information that can be used to improve performance, such as helpful strategy information. Thus, task feedback is an important aspect of the feedback environment but not necessarily sufficient for optimal performance change. In addition, individuals may differ in their preferences for feedback

(e.g., preference for externally-mediated versus internally-mediated feedback). These individual differences affect how recipients perceive and respond to the feedback environment and must be taken into consideration when examining the effects of feedback on performance.

Role of Individual Differences

Researchers need to be concerned with how their feedback interventions may result in different outcomes for different individuals. Whereas much performance feedback literature has focused on how the feedback environment influences the individual, a recent stream of research has recognized the active role of the recipient in the feedback process (e.g., Ashford & Cummings, 1983; Herold & Fedor, 2003; Herold, Parsons, & Rensvold, 1996; Renn, 2003; Williams et al., 1998). These researchers have argued for placing more research emphasis on the role of individual differences in the feedback process (Herold & Fedor, 1998).

Researchers examining performance feedback have acknowledged the importance of individual differences in recipients, but the influence of various individual difference factors in the feedback process is not clear. Indeed, in their model of the effects of feedback on recipients, Ilgen, Fisher, and Taylor (1979) described individual differences as having an influence at each phase of their model. They suggested that variables, such as locus of control, self-esteem, and social anxiety, would affect how recipients responded to feedback. Later research revealed self-esteem as a moderator of motivation to seek negative feedback (Ashford, 1989). Similarly, Fedor, Rensvold, and Adams (1992) found that individuals with low self-esteem were less likely to seek performance feedback. Moreover, Fedor (1991) incorporated individual differences in his model,

identifying several potentially influential personality variables, including self-esteem, tolerance for ambiguity, self-efficacy, and internal and external feedback propensities. However, in their meta-analysis of feedback interventions, Kluger and DeNisi (1996) were unable to test for the effects of individual differences because there were not enough studies that examined the moderating effects of personality variables.

Internal and External Feedback Propensities

Researchers have identified internal and external feedback propensities as important individual difference variables in the feedback process. I will focus on internal and external feedback propensities rather than other previously identified global personality factors (e.g., self-esteem, locus of control) because feedback propensity is a domain-specific individual difference, in that it characterizes certain qualities brought on by a particular context (Herold & Fedor, 1998). Global individual difference variables have had limited success in predicting behavior in specific situations (Mischel & Shoda, 1995). Thus, when attempting to study responses in a specific context, it is more appropriate to examine specific individual differences that apply to that particular context.

Researchers (e.g., Herold & Fedor, 1998) have called for better conceptualizations of individual differences that are relevant in particular contexts of interest (e.g., performance feedback). Herold and Fedor (1998) view the domain-specific approach more useful for predicting behavior. By using a more "targeted conceptualization of predispositions" (p. 236), domain-specific individual differences can be applied to behavior in a particular kind of situation that does not necessarily generalize to other dissimilar situations. Using individual difference variables targeted toward certain

situations enables researchers to find stronger relationships between specific predictors and specific criteria.

Thus, in the performance feedback context, individuals are active participants who shape their own feedback environments (Ashford & Cummings, 1983). Individuals seek, generate, and monitor performance cues, and how individuals respond to these performance cues is influenced by feedback-related individual differences (Herold & Fedor, 1998). By identifying the specific differences in how individuals generate, process, and respond to performance feedback, we can better understand the relationships between feedback and various outcomes of interest (e.g., performance, learning) that may be difficult to identify through use of broader personality variables.

Researchers have identified internal and external feedback propensities as individual differences specific to the performance feedback context. First identified by Herold and Parsons (1977), internal and external feedback propensities describe individuals' preferences for either external (e.g., co-workers, supervisor) or internal (e.g., self) feedback sources. Originally conceptualized as a single dimension, theorists currently view internal and external propensities as two distinct dimensions (Herold & Fedor, 2003). External propensity reflects a preference for feedback from others in the environment. It is important to note that external propensity does not imply a disregard for internal sources but a reliance on external sources of feedback. Internal propensity reflects self-reliance and a preference and value for self-mediated feedback (Herold, Parson, & Rensvold, 1996). When there is a contradiction between self-mediated feedback and external feedback, individuals with a high internal feedback propensity tend to reconcile the inconsistency in favor of the self-assessment (Herold & Fedor, 1998).

However, reliance on lower quality feedback from the self can impede learning during skill acquisition, especially at the early stages of learning.

Research on Internal and External Feedback Propensities

Although the feedback propensities constructs are still relatively unresearched, initial research findings (e.g., Herold et al., 1996; Renn & Fedor, 2001) are encouraging. Researchers have developed measures in diverse samples and various organizational settings that achieve acceptable internal consistencies (alpha) (e.g., Herold et al., 1996; Herold & Fedor, 1998). In addition, measures of feedback propensities demonstrated convergent and discriminate validity with other measures of individual differences, further embedding the construct within a larger nomological network (Herold & Fedor, 1996). Consistent with their predictions, Herold et al. (1996) found that internal feedback propensity was positively correlated with self-esteem and need for achievement and negatively correlated with public self-consciousness. External feedback propensity was negatively correlated with tolerance for ambiguity and positively correlated with public self-consciousness.

Several researchers have examined the role of feedback propensity in effects of feedback on performance. Internal feedback propensity was related to better performance for individuals with internal feedback ability, or the perceived ability to generate accurate feedback about one's performance (Brief & Hollenbeck 1984). Thus, the ability to assess accurately one's own behavior may have important implications for performance. In addition, external feedback propensity was found to be positively associated with trainee performance in early phases of training (Fedor et al., 1992; Herold & Fedor, 1998). Renn and Fedor (2001) found that feedback seeking mediated the relationship between external

feedback propensity and performance, suggesting that individuals more interested in acquiring performance feedback make better use of such performance information than individuals with less desire for external feedback. In contrast, high internal feedback propensity was associated with lower levels of performance in flight-simulator training (Herold & Fedor, 1998). During actual flight performance assessments, Herold and Fedor (1998) found that, although past performance was the best predictor of subsequent performance, the level of flight simulator performance interacted with feedback propensities to explain variance in cockpit performance.

An improved understanding of the role of individual feedback propensities in training outcomes will aid in the development of more effective training programs using feedback systems. Recent research in this area has demonstrated the potential influence of domain-specific individual difference variables, such as feedback propensities, on skill acquisition and performance. Examining how feedback propensities affect task mastery can lead to a better understanding of skill acquisition (Herold & Fedor, 1998). Herold and Fedor (2003) offered several predictions concerning feedback propensity, skill acquisition, and training performance. Specifically, high external feedback propensity should facilitate training performance in situations where external feedback is readily available, whereas in situations without external feedback, high external propensity should not be associated with better performance. In addition, they also expected internal propensity to be associated with better performance maintenance over time, compared to external propensity. Furthermore, they posited a detrimental effect of high internal feedback propensity at early stages of skill acquisition. This proposition is, to some extent, supported by studies cited above, with the interpretation that individuals

high in internal feedback propensity will ignore or deny external feedback that is necessary for mastery of novel tasks (Herold & Fedor, 1998; 2003).

However, most studies examining internal and external feedback propensities use external feedback from human sources or internal feedback in the form of self-assessments. Few studies have examined the influence of feedback propensities with computer-mediated feedback, which is becoming important with the increasing use of computerized training programs. In addition, different types of feedback (e.g., process-outcome, task-external) available during training may have differential effects on individuals, depending on their feedback propensities.

Purpose of Current Study

Feedback research has been inconsistent regarding the effectiveness and necessity of external feedback for skill acquisition and learning. Whereas many researchers have concluded that external feedback is beneficial and/or necessary for learning (e.g., Ammons, 1956; Ilgen at al., 1979), several studies that examine the effects of feedback on motor learning contradict this position (Salmoni et al., 1984). A more recent investigation (Goodman, 1998) found that task feedback resulted in better learning compared to externally presented feedback (e.g., feedback from others). Goodman (1998) found that external feedback was associated with superior performance during practice sessions, but the effects did not carry over to learning sessions, during which individuals previously provided with task feedback (and not external feedback) performed better. This study reinforces Kluger and DeNisi's (1996) argument that the effects of feedback interventions are variable and do not always result in improved performance levels. Several researchers have proposed that externally-provided feedback

may hinder learning because the feedback cues that individuals rely upon during practice performance serve as a crutch; thus, shortcutting the need for learning task rules and recognizing errors (Kluger & DeNisi, 1996; Salmoni et al, 1979). Thus, they claim task feedback, on the other hand, forces the individual to detect and correct errors (Goodman, 1998), which better facilitates learning.

However, the line of research that examines the effects of external feedback versus task feedback has raised several issues. For example, external feedback manipulations have contained the combination of process and outcome feedback (e.g., Goodman, 1998), despite the negative effects of outcome feedback on performance cited in the feedback literature (e.g., Jacoby et al., 1984). As previously noted, process and outcome feedback provide different types of performance information to individuals and can have differential effects on performance. One purpose of the proposed study, then, is to disentangle the effects of process and outcome feedback.

Another issue raised by research on external feedback relates to the amount of information contained in the external feedback manipulations. In Goodman's (1998) study, the external feedback provided to individuals was redundant with the information provided by the task. However, existing feedback literature has emphasized that feedback messages need to provide the incremental knowledge of performance, or information above and beyond information already possessed by the individual (Ilgen at al., 1979). Otherwise, feedback recipients may question the usefulness of such feedback. In fact, claims that external feedback serves as a crutch and reduces error detection are questionable when the external feedback manipulation fails to provide any additional information about one's performance outside of the information provided by the task.

Thus, researchers need to address the efficacy of providing external feedback above and beyond performance information supplied by the task itself. The external feedback manipulations in this proposed study will provide performance information beyond information provided by task feedback.

Finally, a third issue raised by this line of research relates to individual differences. It is important to consider how different types of feedback interact with relevant personality variables to influence changes in behavior and performance. The final purpose of this proposed study is to examine the interactive effects of individual differences with different types of feedback.

Thus, the current study will extend prior research in three ways. First, I will examine the effects of process, outcome, and task feedback on performance. Second, I examine the differential effects of process, outcome, and task feedback when the performance information is not redundant. Each type of feedback will provide unique performance information to the participants. Finally, I will examine how process, outcome, and task feedback interact with internal and external feedback propensities.

Studies that confound feedback manipulations by combining outcome and process information (e.g., Early et al., 1989; Korsgaard & Diddams, 1996) may be trying to examine the additive effects of such information, but these researchers are disregarding the existing research on the differential effects of process versus outcome feedback (e.g., the possible dysfunctional effects of outcome feedback may negate beneficial effects of process feedback). Thus, conclusions regarding the effectiveness of external feedback based on studies that combine outcome and process feedback in an uncontrolled manner. Therefore, separating the effects for outcome and process feedback, rather than

combining the two forms together as an 'external feedback manipulation,' may produce different results.

I expect to observe that outcome feedback has no effect on performance and process feedback has a beneficial effect on performance during skill acquisition. Because I am examining only initial skill acquisition, outcome feedback is not expected to debilitate performance. The detrimental effects of outcome feedback have appeared primarily in studies that examined its long-term effects (e.g., Jacoby et al., 1984).

More specifically, I propose that process feedback will direct attention to task-relevant cues and promote a more focused information search, resulting in improved task-performance strategies. Process feedback should facilitate better strategy development and supplement the information provided by task feedback, resulting in better performance.

Task feedback is a direct result of performing the task and is considered inherent to the task. In general, task feedback is inseparable from the task and performing without the presence of the task feedback should be difficult. Therefore, I also expect a beneficial effect of task feedback on task performance. Moreover, task feedback effects will be enhanced in the presence of process feedback. Because I am interested in examining the effects three different feedback types, each providing distinct performance information, the task feedback information is expected to be most important because it is inherent to the task, resulting directly from task execution. The process information is expected to augment information provided by the task and the combination of task and process feedback should result in the best performance.

H_1: Process feedback and task feedback will interact in their effects on task performance. Specifically, across outcome feedback conditions, individuals receiving task and process feedback will perform best, followed by individuals receiving task but not process feedback, and then individuals receiving process but not task feedback. Individuals receiving neither type of feedback will perform worse than the other conditions.

In addition, the individual difference factor, feedback propensity (Herold & Parson, & Rensvold, 1996), should influence how recipients will respond to external feedback. Because individuals high in external feedback propensity attend to external feedback cues, initial performance on novel tasks should be relatively high for these individuals compared to individuals low in external feedback propensity. High external feedback propensity is expected to be particularly beneficial for initial skill acquisition when combined with process feedback because these individuals are expected to attend closely to the process information provided, resulting in optimal strategy development and enhanced performance. Thus, I expect to observe feedback propensity as a moderator of the effects of process feedback on performance. Specifically, process feedback will have a stronger effect for those individuals with a high external feedback propensity than for those individuals with a low external feedback propensity. To the extent that external feedback is not provided to individuals with an external feedback propensity, performance will be debilitated.

H_2: External feedback propensity will moderate the effects of process feedback on performance. Specifically, process feedback will have a stronger

effect on performance for individuals with a high external feedback propensity than individuals with a low external feedback propensity.

During the initial stages of skill acquisition, individuals high in internal feedback propensity are expected to perform poorly on novel tasks due to the interference of internal propensity with external learning cues needed on initial phases of skill acquisition because individuals with internal propensity may ignore or disregard external learning cues (Herold & Fedor, 2003). These individuals may not attend to the required external feedback necessary to for task mastery. Inattention to external cues in early skill acquisition may lead us to expect that individuals high in internal feedback propensity would perform worse overall. However, it may be true that the consequences of inattention to external cues would depend on the actual performance of the individual. Consequences for individuals performing poorly are different from those individuals performing well. Individuals may differ in their abilities to effectively derive task information from the task or to self-assess their own performance. Individuals high in internal feedback propensity that derive enough information from the task to perform well initially would not need external feedback cues to effectively perform the task. Thus, disregarding external feedback for such individuals would not negatively affect their performance. In contrast, individuals high in internal feedback propensity who are performing poorly would benefit from external cues because they are not deriving enough information from the task or themselves. However, to the extent they disregard external feedback needed for effective skill acquisition, their performance would suffer. Therefore, I expect that the effect of high internal feedback propensity on overall task

performance will be moderated by initial performance, or performance on the first trials of the task.

H_3: Initial task performance will moderate the effects of internal feedback propensity on task performance. Specifically, high internal feedback propensity will negatively affect overall task performance for individuals with poor initial performance whereas high internal feedback propensity will positively affect overall task performance for individuals with good initial performance.

Method

Participants

Participants ($N = 252$) were recruited from a pool of undergraduate students enrolled in an introductory psychology course at a mid-western university and participated in exchange for extra credit points.

Design

This study used a 2 (outcome feedback versus no outcome feedback) x 2 (process feedback versus no process feedback) x 2 (task feedback versus no task feedback) x 4 (trial blocks) experimental design to test the effects of three feedback types on task performance, with internal and external feedback propensities as continuous factors. Participants were randomly assigned to either the presence or absence of process, outcome, and task feedback. Trial block was the only within subjects factor. All participants completed two practice trials and four test trials of the task.

Task

Participants performed a computerized version of the board game MASTERMIND developed by Steele-Johnson for use in her lab. Participants were

provided with detailed instructions and rules. The task required individuals to attempt to identify a pre-defined code consisting of five colored "pegs" (selected from eight available colors) placed in five "holes" in a row. The objective of the task was to identify the pre-existing code in the fewest guesses. Participants could choose a combination of five colors from eight possible colors and put the colors in varying orders to guess the code. After each row of colors was completed, participants pressed the 'enter' key to see if the code was correct or not. Each time a participant completed a row of colors and hit the 'enter' key, it counted as a 'guess.' If the guess was incorrect, the participant continued to create another guess on the next row. The trial ended either once the participant identified the correct code or once 10 minutes elapsed. If the participant ran out of time, the program moved to the next trial.

Manipulations

I examined two types of external feedback, outcome feedback and process feedback, and one type of task feedback.

Outcome feedback. Participants either received outcome feedback or not. Outcome feedback was operationally defined as information on how many attempts the subject made before solving the code. Outcome feedback was presented on a computer screen after participants completed each trial of the task. Participants in the no outcome feedback conditions did not receive the information described above.

Process feedback. The process feedback condition provided process information on a computer screen one time after each trial. Process feedback provided information on how participants should proceed with performing the task and no information on actual

performance. Participants in the no process feedback conditions did not receive the information described above.

Task feedback. Task feedback is feedback that results directly from performing the task. Participants receiving task feedback received two types of feedback after each attempt to solve the code: 1) the number of correct colors in the correct holes and 2) the number of correct colors in the wrong holes. Those participants in the no task feedback condition did not receive any of the information described above.

Measures

Task performance. I operationalized task performance as the number of guesses required to identify the code. I assessed performance in each of four task trials.

Feedback propensity. I assessed feedback propensity at the beginning of the session using an individual difference measure developed by Herold and his colleagues (e.g., Fedor, et al., 1992; Herold & Parsons, 1985; Herold et al., 1996). This measure consists of two 6-item subscales, measuring external feedback propensity (e.g., "It is very important to me to know what people think of my work") on the first subscale and internal feedback propensity ("What I think of myself and my work is more important to me than what others think") on the second subscale. Participants responded on a 5-point, Likert-type scale (1 = "strongly disagree", "5 = "strongly agree"). Appendix A presents the complete sets of items for this measure. Herold et al. (1996) reported internal consistency reliabilities for internal propensity and external propensity of .70 and .83, respectively. Internal consistency reliabilities for this sample were .63 for internal propensity and .75 for external propensity. To identify external and internal feedback propensities, I summed the item scores for each subscale separately. Thus, each

participant had two scores, one for internal feedback propensity and one for external feedback propensity. A high score on the external feedback propensity scale indicates an external feedback propensity, whereas a high score on the internal feedback propensity scale indicates an internal feedback propensity. If a participant scored high on both subscales, those scores indicate an internal and external feedback propensity, or a preference for both types of feedback.

Revised feedback propensities measures. Revised external and internal feedback propensity measures were developed specifically for the current study. The purpose of the revised measures was to improve the relevance of the measures to the specific context in the current study, as well as to improve upon the psychometric properties of the original 6-item scales. The revised external feedback propensity measure consisted of 16 items that addressed preferences for feedback that did not specifically relate to receiving feedback from other people, as external feedback in the current study was defined as computer-mediated feedback. The revised internal feedback propensity measure consisted of 22 items that addressed preferences for receiving feedback from the task. Data on the revised measures were collected in a pilot study. After examination of the psychometric properties, I removed 2 items from the revised external feedback propensity measure and 8 items from the internal feedback propensity measure due to poor item intercorrelations, yielding two final 14-item scales. Internal consistency reliabilities for the revised external feedback propensity and revised internal feedback propensity measures were .91 and .85, respectively.

Feedback manipulation check. A feedback manipulation check (see Appendix B) was developed specifically for the current study. It consisted of 9 items that addressed

the usefulness, accuracy, and trustworthiness of the feedback information provided during the task. This manipulation was tested for effectiveness during a separate pilot study. Participants responded on a 5-point Likert-type scale (1 = "strongly disagree", 5 = "strongly agree"). The internal consistency for the composite measure was .93. The internal consistencies for the usefulness, accuracy, and trustworthiness subscales were .85, .86, and .82, respectively.

Cognitive ability. The Wonderlic Personnel Test Form II (Wonderlic, 1992) is a measure of general cognitive ability. The Wonderlic measure is a 12 minute speeded test with a total of 50 items. This measure addresses verbal, mathematical, and analytical general ability levels. Reported test-retest reliabilities for this measure range from .82 to .94 (Wonderlic, 1992). I included this measure to test alternative hypotheses.

Goal Orientation. Goal orientation was assessed using Vandewalle's (1997) measure (see Appendix C). This measure consisted of a 13-item, 6-point Likert-type scale (1 = "strongly disagree", 6 = "strongly agree"). Vandewalle (1997) reported internal consistency reliabilities for the learning, prove, and avoid subscales of .88, .84, and .83, respectively. The coefficient alphas observed in the present experiment were: .82 for the learning subscale, .73 for the prove subscale, and .77 for the avoidance subscale. I included this measure to test alternative hypotheses.

Locus of control. Internal and external locus of control was assessed using Rotter's (1966) Internal-External Scale (see Appendix D). This measure consisted of a 29-item, forced-choice scale, in which individuals selected one alternative from each pair of statements. Reported test-retest reliabilities for this measure range from .49 to .83, and

reported internal consistency reliabilities for this measure range from .65 to .76 (Rotter, 1966). I included this measure to test alternative hypotheses.

Self-esteem. Self-esteem was assessed using Coopersmith's (1975) 25-item self-esteem measure (see Appendix E). Participants responded on a 6-point scale, ranging from 1 = very unlike me to 6 = very like me. Reported internal consistency reliabilities for this measure range from .75 to .83 (Ahmed, Valliant, & Swindle, 1985; Van Tuinen & Ramanaiah, 1979). The coefficient alpha observed in the present experiment was .85. I included this measure to test alternative hypotheses.

Self-consciousness. Self-consciousness was assessed using a modified version of the Self-Consciousness Scale (Fenigstein, Scheier, & Buss, 1975) developed by Scheier and Carver (1985). This measure (see Appendix F) consists of 22 items, using the following response format: 3 = a lot like me, 2 = somewhat like me, 1 = a little like me, and 0 = not at all like me. This measure consists of three subscales assessing three dimensions, private self-consciousness, public self-consciousness, and social anxiety, with reported internal consistency reliabilities of .75, .84, and .79, respectively (Scheier & Carver, 1985). The coefficient alphas observed in the present experiment were: .79 for the public self-consciousness scale, .78 for the private self-consciousness scale, and .83 for the social anxiety scale. I included this measure to test alternative hypotheses.

Self-efficacy. Self-efficacy was assessed using a 7-item modified version of the Riggs et al. (1994) Personal Efficacy Scale (see Appendix G). Riggs et al. reported an internal consistency reliability for the original scale of .86. In the present sample, I observed internal consistency reliabilities of .73, .71, .76, .69, and .67 for trials 1 through 5, respectively. The original items have been revised to pertain to the current task.

Participants responded on a 7-point Likert-type scale (1 = "strongly disagree", 7 = "strongly agree"). I included this measure to test alternative hypotheses.

Intrinsic Motivation. Intrinsic motivation was assessed using a 21-item scale (see Appendix H) examined by McAuley, Wraith, and Duncan (1991). This measure is based on the original 9-item inventory of intrinsic motivation developed by Ryan (1982; 1981/1982). The scale includes items addressing different aspects of intrinsic motivation (e.g., competence, interest/enjoyment, and effort/importance). Reported internal consistency reliabilities range from .54 to .92 (McAuley, Wraith, & Duncan, 1991). In the current sample, internal consistencies were high for the composite scale (with coefficient alphas were greater than .77) and fair for the subscales (with coefficient alphas ranging from .53 to .90, see Table 1). Participants responded using a 7-point Likert-type scale (1 = "strongly disagree", 7 = "strongly agree"). I included this measure to test alternative hypotheses.

Subjective task complexity. Perceived task complexity was assessed using a 10-item scale (see Appendix I) adapted from scales developed by Steele-Johnson, Beauregard, Hoover, and Schmidt (2000) and Maynard and Hakel (1997). Coefficient alphas observed in the current study all exceeded .70, with coefficient alphas of .79, .83, .85, .82, .82, and .79 for trials 1 through 6, respectively. Participants responded on a 7-point Likert-type scale (1 = "not at all", 7 = "very"). I included this measure to test alternative hypotheses.

Demographics. I collected demographic information using a questionnaire designed for this study (e.g., age, gender; see Appendix J). I used this information to examine alternative hypotheses.

Table 1

Internal Consistencies for Intrinsic Motivation Composite Scale and Subscales

	Trial Number					
Scale	1	2	3	4	5	6
Composite Score	.82	.85	.85	.83	.83	.78
Intrinsic Enjoyment	.87	.88	.86	.87	.85	.83
Perceived Competence	.73	.82	.85	.89	.87	.84
Effort-Importance	.69	.67	.64	.60	.57	.63
Tension-Pressure	.71	.70	.68	.55	.53	.54
Choice	.65	.84	.84	.84	.90	.78

Procedure

Up to 6 participants could participate in the experiment simultaneously. Participants worked at individual PC computers with 12-inch monitors. First, participants completed an informed consent process (see Appendix K). Subjects then completed the following paper measures: the Wonderlic test, the locus of control measure, and the revised feedback propensities measures. Next, participants were asked to begin their computer sessions by pressing the 'enter' button. Before the first trial, participants completed the following measures on the computer: external and internal feedback propensities, goal orientation, self-esteem, self-consciousness, and demographic measures. Participants then received instructions regarding the nature of the task. Task instructions were presented on the computer monitor prior to the first practice trial and corresponded to the specific condition that the participant was in.

Participants performed two practice trials and four trials of the task. I assessed performance after each trial. At the end of each trial, participants in the outcome feedback conditions received outcome feedback. Similarly, at the end of each trial, participants in the process feedback conditions received process feedback. Participants in the no external feedback conditions did not receive any external outcome or process feedback messages. Participants in the high task feedback conditions received information on the number of correct colors in the correct holes and wrong holes after each attempt to solve the code. Participants in the no task feedback conditions did not receive this information. When the participant identified the correct code, each trial automatically ended. If a participant could not solve the code in less than 10 minutes, the program moved to the next trial so the participant could continue working. Subjective

task complexity, intrinsic motivation, and self-efficacy were assessed after each of the first 5 trials. After the final trial, the subjective task complexity measure, the intrinsic motivation measure, and the feedback manipulation check measure were administered. Participants were instructed to quietly raise their hands after they received the 'session complete' message on the computer. They were then given extra credit points and dismissed.

Results

Sample Characteristics

Two hundred and fifty two subjects participated in the study. Of the 252 participants, 21 participants were removed from the analyses due to missing data and/or patterned responses (e.g., responses reflected that the participants answered randomly, not based on actual items). In order to achieve equal sample sizes within each condition, an additional 15 participants were randomly excluded from the analyses, resulting in a final sample of 216 participants. Table 2 lists the participants deleted from the analysis, the experimental condition they were in, and the reason for deletion.

Demographic characteristics of the sample are listed in Table 3 (see Table 4 for demographics of deleted participants). The sample consisted of approximately 65% females, and approximately 95% of the participants were age 23 or younger. These sample demographics are consistent with the demographics of the subject pool at the university where the experimental data was collected. (Note: The group of deleted subjects also reflected demographics similar to subject pool).

Table 2

Participants Deleted from Study

Subject #	Reason for Deletion
No Feedback Condition	
0342	Patterned responses
0344	Patterned responses
0356	Randomly deleted
Task Only Condition	
0226	Randomly deleted
0228	Patterned responses
0229	Randomly deleted
0268	Randomly deleted
Process Only Condition	
0221	Missing data for all task performance trials
0222	Randomly deleted
0401	Patterned responses
0433	Randomly deleted
Outcome Only Condition	
0322	Patterned responses
0323	Randomly deleted
0329	Patterned responses
0429	Patterned responses
Task + Process Condition	
0233	Patterned responses
0237	Missing data for all task performance trials
0240	Randomly deleted
0247	Randomly deleted
0436	Randomly deleted
Task + Outcome Condition	
0252	Patterned responses
0274	Patterned responses
0457	Patterned responses
0460	Patterned responses

Table 2 (continued)

Subject #	Reason for Deletion
Process + Outcome Condition	
0218	Randomly deleted
0285	Randomly deleted
0293	Patterned responses
0391	Randomly deleted
Task + Process + Outcome Condition	
0200	Patterned responses
0221	Randomly deleted
0296	Missing data for all task trials
0297	Missing data for all task trials
0300	Missing data for all task trials
0302	Missing data for all task trials
0308	Patterned responses
0315	Randomly deleted

Table 3

Frequency Distributions of Demographic Variables for Study Sample

Demographic	Category							
Gender								
	Male		Female					
Frequency	75		141					
Percent	34.7%		65.3%					
Age								
	18	19	20	21	22	23	24	25+
Frequency	74	79	34	10	7	1	2	9
Percent	34.3%	36.6%	15.7%	4.6%	3.2%	0.5%	0.9%	4.2%
Major								
	Business	Computers	English/ Communications		Social Sciences	Other		
Frequency	24	3	21		23	145		
Percent	11.1%	1.4%	9.7%		10.6%	67.1%		
GPA								
	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	No GPA			
Frequency	7	28	79	84	18			
Percent	3.2%	13.0%	36.6%	38.9%	8.3%			

Note. $N = 216$.

Table 4

Frequency Distributions of Demographic Variables for Deleted Participants

Demographic	Category							
Gender								
	Male			Female				
Frequency	12			24				
Percent	33.3%			66.7%				
Age								
	18	19	20	21	22	23	24	25+
Frequency	9	10	6	1	1	3	0	6
Percent	25.0%	27.8%	16.7%	2.8%	2.8%	8.3%	0.0%	16.7%
Major								
	Business	Computers	English/ Communications		Social Sciences	Other		
Frequency	7	0	2		2	25		
Percent	19.4%	0.0%	5.6%		5.6%	69.4%		
GPA								
	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	No GPA			
Frequency	1	6	11	15	3			
Percent	2.8%	16.4%	30.5%	41.7%	8.3%			

Note. $N = 36$.

The Brown-Forsythe test was used to test for homogeneity of variances. Results of this test suggested the assumption of equal variances was not met, $F(7, 208) = 12.09$, $p = .001$. However, the standard tests for equality of variances are extremely sensitive to any departure from normality in the populations, thus analysis of variance is relatively robust and can be appropriate when the groups are all about the same size (Box, 1953).

Because participants were randomly assigned to study conditions, I expected cognitive ability to be evenly distributed across conditions. In order to test whether cognitive ability was evenly distributed across the eight conditions, I conducted a three-way ANOVA, entering outcome, process, and task feedback as predictors of ability. If cognitive ability was evenly distributed, I should observe no effects of feedback manipulations on cognitive ability. However, with an alpha level of .05, results revealed a significant effect of feedback manipulations on ability, meaning that ability was not evenly distributed among feedback conditions (see Table 5). To determine which conditions significantly differed in cognitive ability, I conducted a post hoc test of all differences between means, using the Tukey HSD method to adjust for multiple comparisons. Results revealed that the cognitive ability mean for the outcome and task condition ($M = 24.26$, $SD = 5.38$) was significantly higher than the means for the no feedback condition ($M = 19.33$, $SD = 6.47$) and the outcome and process condition ($M = 18.30$, $SD = 6.23$). Refer to Table 6 for cognitive ability means and standard deviations for each experimental condition.

Table 5

Effects of Feedback Manipulations on Cognitive Ability

Source	*df*	*F*	*p*
Outcome feedback	1	0.28	.594
Process feedback	1	1.80	.180
Task feedback	1	4.06	.045
Process * Outcome	1	10.96	.001
Outcome * Task	1	0.62	.432
Process * Task	1	0.09	.763
Outcome * Process * Task	1	0.11	.746
Error	215		

Note. $N = 216$.

Table 6

Means and Standard Deviations for Ability within Feedback Conditions

Condition	Feedback Manipulations	Ability		
		N	*M*	*SD*
1	No feedback	27	19.33	6.47
2	Task only	27	20.30	5.63
3	Process only	27	20.89	5.92
4	Outcome only	27	21.52	5.68
5	Task + process	27	21.89	6.38
6	Task + outcome	27	24.26	5.38
7	Process + outcome	27	18.30	6.23
8	Task + process + outcome	27	20.04	5.20

Note. $N = 216$.

Descriptive Statistics

Dependent variables. The means and standard deviations were calculated for each condition across the six task performance trials (see Table 7). The marginal means for each feedback manipulation are displayed in Table 8. Overall, performance tended to decrease as participants progressed through task trials.

Internal and external feedback propensities. Table 9 displays the means, standard deviations, and intercorrelations for the original feedback propensities scales and the revised feedback propensities scales. As Table 9 indicates, the revised measures are significantly correlated with the original feedback propensities measures in the expected directions. The bivariate correlations between each feedback propensity measure and each performance trial are displayed in Table 10.

Manipulation Checks

In order to ensure that the feedback manipulations had the intended psychological effects, I assessed the effectiveness of the feedback manipulations by examining the participants' perceptions. Specifically, I examined the effects of the feedback manipulations on three task perception measures: feedback effectiveness, subjective task complexity, and intrinsic motivation. For means and standard deviations of scores on these scales (and subscales) within the eight experimental conditions, refer to Tables 11, 12, and 13.

Feedback effectiveness measure. Successful manipulations should result in differences in perceptions of feedback effectiveness for each feedback type, as well as combinations of different feedback types. In order to examine the effects of the feedback

Table 7

Descriptive Statistics for Task Performance within Feedback Conditions

		Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		Trial 6		Avg Trial 3-6	
Condition	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
No Feedback	27	61.26	19.79	102.22	71.61	117.70	77.96	105.70	55.27	141.11	71.94	160.00	85.68	131.13	56.34
Task only	27	25.33	17.23	27.22	22.66	25.81	18.91	28.26	25.04	28.26	35.34	25.85	33.01	27.05	26.50
Process only	27	65.30	30.09	89.15	39.66	112.67	62.82	113.11	65.04	110.89	78.89	108.56	81.08	111.31	62.63
Outcome only	27	63.89	35.67	100.67	62.49	95.56	59.65	133.52	90.05	130.04	97.56	147.41	99.78	126.63	74.52

Table 7 (continued)

		Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		Trial 6		Avg Trial 3-6	
Condition	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Task + Process	27	32.22	20.23	31.00	25.60	30.44	35.18	28.52	28.19	27.93	33.07	28.89	30.06	28.94	29.88
Task + Outcome	27	22.74	19.17	22.63	27.77	24.70	34.71	21.74	16.02	21.33	14.56	22.59	16.01	22.59	15.16
Process + Outcome	27	60.44	24.79	117.93	65.81	138.96	90.79	147.52	97.48	146.48	101.62	130.19	86.86	140.79	85.96
Process + Outcome + Task	27	22.56	13.75	21.26	16.63	19.15	9.79	22.52	17.27	28.60	35.59	31.41	46.91	25.41	23.98

Table 8

Descriptive Statistics for Task Performance within Feedback Manipulations

		Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		Trial 6		Avg Trial 3-6	
Condition	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Total Sample	216	44.22	29.86	64.01	60.19	70.63	72.15	75.11	76.74	79.33	84.50	81.86	86.80	76.73	73.20
Task Feedback	108	25.71	17.95	25.52	23.53	25.03	26.83	25.26	22.14	26.53	30.62	27.19	33.05	26.00	24.26
No Task Feedback	108	62.72	27.88	102.49	61.12	116.22	74.45	124.96	79.53	132.13	88.21	136.54	89.50	127.46	70.59
Process Feedback	108	45.13	29.10	64.83	57.35	75.31	77.22	77.92	80.79	78.47	85.44	74.76	79.08	76.61	75.38
No Process	108	43.31	30.70	63.19	63.15	65.94	66.74	72.31	72.73	80.19	83.94	88.96	93.71	76.84	71.31
Outcome Feedback	108	42.41	31.45	65.62	64.96	69.59	75.61	81.32	89.31	81.61	91.99	82.89	89.72	78.86	80.02
No Outcome	108	46.03	28.20	62.40	55.26	71.66	68.86	68.90	61.47	77.05	76.64	80.82	84.17	74.61	65.99

Table 9

Means, Standard Deviations, and Intercorrelations of Feedback Propensity Measures

Variables	*M*	*SD*	1	2	3	4
1. External Feedback Propensity	3.77	.59	--			
2. Internal Feedback Propensity	3.52	.59	-.03	--		
3. External Feedback Propensity (Revised)	3.89	.50	.27**	-.14*	--	
4. Internal Feedback Propensity (Revised)	3.03	.55	-.10	.28**	-.07	--

Note. $N = 216$. *$p < .05$. **$p < .01$.

Table 10

Means, Standard Deviations, and Intercorrelations of Feedback Propensity Measures and Performance Trials

Variables	*M*	*SD*	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
External Feedback Propensity	3.77	.59	.00	.12	.08	.11	.09	.04
Internal Feedback Propensity	3.52	.59	.14*	.15*	.12	.09	.07	.04
External Feedback Propensity (Revised)	3.89	.50	-.17**	-.09	-.15*	-.08	-.05	-.03
Internal Feedback Propensity (Revised)	3.03	.55	-.01	-.05	-.02	-.15*	-.09	-.05

Note. $N = 216$. *$p < .05$. **$p < .01$.

Table 11

Means and Standard Deviations of Feedback Perception Measures within Conditions

Condition	Feedback Effectiveness		Usefulness		Accuracy		Trustworthiness	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Condition 1: All	3.62	0.62	3.59	0.82	3.72	0.60	3.53	0.69
Condition 2: P + O	2.88	1.05	2.75	1.16	3.01	1.12	2.92	1.26
Condition 3: P only	2.39	1.25	2.28	1.35	2.44	1.45	2.55	1.53
Condition 4: O only	2.92	1.30	2.86	1.36	3.06	1.32	2.83	1.46
Condition 5: O + T	3.58	1.07	3.34	1.18	3.87	1.05	3.62	1.21
Condition 6: T only	3.75	0.90	3.82	0.84	3.66	1.06	3.75	1.04
Condition 7: P + T	3.65	0.68	3.65	0.80	3.62	0.83	3.66	0.78
Condition 8: None	2.83	1.08	2.73	1.02	2.92	1.37	2.88	1.31

Note. O = outcome feedback; P = process feedback; T = task feedback. $N = 216$.

Table 12

Means and Standard Deviations of Subjective Task Complexity Measures by Condition

Condition	Time 1		Time 2	
	M	*SD*	*M*	*SD*
Condition 1: All feedback	4.46	1.02	3.72	1.17
Condition 2: P + O	4.40	1.38	4.29	1.49
Condition 3: P only	4.29	1.27	4.77	1.36
Condition 4: O only	4.02	1.63	3.94	1.56
Condition 5: O + T	4.32	0.96	3.57	1.06
Condition 6: T only	4.86	1.17	4.14	1.47
Condition 7: P + T	4.95	1.04	4.31	1.23
Condition 8: No feedback	4.20	1.14	3.68	1.15

Note. O = outcome feedback; P = process feedback; T = task feedback. $N = 216$.

Table 13

Means and Standard Deviations of Intrinsic Motivation Composite and Subscales by Condition

	Intrinsic Motivation				Perceived Competence				Intrinsic Enjoyment			
Condition	Time 1		Time 2		Time 1		Time 2		Time 1		Time 2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Condition 1: All	4.26	0.63	4.36	0.66	3.71	1.04	4.24	1.23	3.96	0.97	2.24	1.23
Condition 2: O + P	3.66	0.70	3.67	0.66	2.86	0.87	3.14	1.49	2.86	1.36	3.21	1.19
Condition 3: P only	3.05	0.75	2.88	0.76	2.41	1.16	2.11	1.45	2.09	0.91	2.03	1.31
Condition 4: O only	3.62	0.59	3.41	0.76	3.19	1.32	3.07	1.59	2.65	1.12	2.40	1.11
Condition 5: O + T	4.09	1.12	4.34	0.99	3.34	1.28	4.09	1.14	3.96	1.63	4.11	1.61
Condition 6: T only	3.81	0.72	3.96	0.89	2.88	1.22	3.45	1.49	3.55	1.64	3.66	1.64
Condition 7: P + T	4.08	1.06	4.29	1.23	3.02	1.43	3.96	1.49	3.69	1.86	3.84	1.78
Condition 8: None	3.46	0.78	3.29	0.81	2.92	1.19	3.06	1.24	2.49	1.14	2.29	1.14

Table 13 (continued)

	Effort/ Importance				Tension/ Pressure				Choice			
Condition	Time 1		Time 2		Time 1		Time 2		Time 1		Time 2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Condition 1: All	4.37	0.81	4.51	0.73	5.28	1.08	5.21	1.03	3.97	1.29	4.12	1.54
Condition 2: O + P	4.14	1.37	3.95	0.99	4.68	1.44	4.46	1.38	4.30	1.43	4.06	1.53
Condition 3: P only	3.32	1.37	3.00	1.29	4.75	1.58	5.02	1.59	3.34	1.52	3.13	1.94
Condition 4: O only	3.95	1.18	3.87	1.40	4.93	1.28	4.72	1.38	4.11	1.74	3.67	1.98
Condition 5: O + T	4.22	1.69	4.72	1.33	4.81	1.55	4.82	1.45	4.02	1.59	4.04	2.05
Condition 6: T only	4.39	1.27	4.32	1.57	4.39	1.51	4.35	1.51	3.80	1.26	3.88	1.42
Condition 7: P + T	4.57	1.40	4.63	1.36	4.98	1.34	4.95	1.53	4.19	1.51	4.44	1.66
Condition 8: None	3.61	1.34	3.39	1.17	5.14	1.40	4.91	1.31	3.81	1.56	3.44	1.67

Note. O = outcome feedback; P = process feedback; T = task feedback. $N = 216$.

manipulations on participants' perceptions of feedback effectiveness, I used an ANOVA approach to structure a set of six orthogonal contrasts (See Table 14). (Note: examination of the total sum of squares for these analyses revealed that a seventh contrast would not explain a significant portion of the variance). These contrasts were used to examine participants' perceptions of the feedback on the composite feedback effectiveness measure, as well as the usefulness, accuracy, and trustworthiness subscales. Table 15 summarizes the results of these analyses. Unless otherwise noted, significant differences in contrasts were in the expected direction.

Contrast 1 compared groups that received all three types of feedback (i.e., outcome, process, and task) to groups that received only one type of feedback (i.e., outcome only, process only, and task only). Results revealed significant differences in participants' perceptions of overall feedback effectiveness (all types: $M = 3.62$, $SD = .62$; one type: $M = 3.02$, $SD = 1.28$), usefulness (all types: $M = 3.59$, $SD = .82$; one type: $M = 2.99$, $SD = 1.35$), and accuracy (all types: $M = 3.72$, $SD = .60$; one type: $M = 3.05$, $SD = 1.36$). That is, participants who received outcome, process, and task feedback perceived the feedback provided during the task as more effective, useful, and accurate. However, I did not observe a significant difference in perceptions of trustworthiness (all types: $M = 3.53$, $SD = .69$; one type: $M = 3.04$, $SD = 1.44$) between these groups.

Contrast 2 compared experimental groups that received no feedback to groups that received combinations of two types of feedback (i.e., outcome plus process feedback, outcome plus task feedback, and process plus task feedback). Results revealed significant differences in participants' perceptions of feedback effectiveness (no feedback: $M = 2.83$, $SD = 1.08$; two types: $M = 3.37$, $SD = 1.00$), usefulness (no

Table 14

Description of Orthogonal Contrasts used for Manipulation Checks

	All	O	P	T	O + P	O + T	P + T	None
ψ_1	3	-1	-1	-1	0	0	0	0
ψ_2	0	0	0	0	1	1	1	-3
ψ_3	0	-1	-1	2	0	0	0	0
ψ_4	0	-1	1	0	0	0	0	0
ψ_5	0	0	0	0	-2	1	1	0
ψ_6	0	0	0	0	0	-1	1	0

Note. O = outcome feedback; P = process feedback; T = task feedback.

Table 15

Summary of Contrasts Testing for Differences in Feedback Perceptions

	Feedback Effectiveness (Composite)		Usefulness		Accuracy		Trustworthiness	
	F	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Contrast 1								
1 type vs. all	6.94	.009	6.14	.014	7.06	.008	3.36	.068
Contrast 2								
2 types vs. none	5.64	.018	4.61	.032	5.28	.022	3.80	.052
Contrast 3								
O/P vs. T	20.66	.000	23.53	.000	11.64	.000	14.24	.000
Contrast 4								
O vs. P	3.52	.062	3.72	.055	3.98	.047	0.73	.394
Contrast 5								
O+T/P+T vs. O+P	9.32	.002	8.26	.004	7.65	.006	6.55	.011
Contrast 6								
O+T vs. O+P	0.06	.813	1.12	.291	0.64	.425	0.01	.909

Note. O = outcome feedback; P = process feedback; T = task feedback. $N = 216$.

feedback: $M = 2.73$, $SD = 1.02$; two types: $M = 2.99$, $SD = 1.35$), and accuracy (no feedback: $M = 2.92$, $SD = 1.37$; two types: $M = 3.05$, $SD = 1.36$), indicating that groups receiving two types of feedback perceived the feedback as more effective, useful, and accurate than groups receiving no feedback. However, I did not observe a significant difference in perceptions of trustworthiness (no feedback: $M = 2.88$, $SD = 1.31$; two types: $M = 3.40$, $SD = 1.14$) between these groups.

Contrast 3 compared groups that received only task feedback to groups that received either only outcome feedback or only process feedback. Results revealed significant differences in participants' perceptions of overall feedback effectiveness (task feedback: $M = 3.75$, $SD = .90$; outcome or process feedback: $M = 2.66$, $SD = 1.29$), usefulness(task feedback: $M = 3.82$, $SD = .84$; outcome or process feedback: $M = 2.57$, $SD = 1.37$), accuracy (task feedback: $M = 3.66$, $SD = 1.06$; outcome or process feedback: $M = 2.75$, $SD = 1.41$), and trustworthiness (task feedback: $M = 3.75$, $SD = 1.04$; outcome or process feedback: $M = 2.69$, $SD = 1.49$). Thus, participants who received only task feedback perceived the feedback as more effective, useful, accurate, and trustworthy than participants who received either only outcome feedback or only process feedback.

To further explore differences between groups that received one feedback type, I used Contrast 4 to compare groups that received only outcome feedback to groups that received only process feedback. Results revealed a marginal difference in perceptions of usefulness (outcome feedback: $M = 2.86$, $SD = 1.36$; process feedback: $M = 2.28$, $SD = 1.35$), and a significant difference in perceptions of accuracy (outcome feedback: $M = 3.06$, $SD = 1.32$; process feedback: $M = 2.44$, $SD = 1.45$). However, the effects were not in the intended direction, as participants who received outcome feedback perceived the

feedback as more useful and accurate compared to participants who received process feedback. I did not find significant differences in perceptions of overall feedback effectiveness (outcome feedback: $M = 2.92$, $SD = 1.30$; process feedback: $M = 2.39$, $SD = 1.25$) or trustworthiness (outcome feedback: $M = 2.83$, $SD = 1.46$; process feedback: $M = 2.55$, $SD = 1.53$) between these groups.

Contrast 5 compared groups that received outcome with process feedback to groups that received either outcome and task feedback or groups that received process and task feedback. Results revealed significant differences in participants' perceptions of feedback effectiveness (outcome + process feedback: $M = 2.88$, $SD = 1.05$; task + outcome or task + process feedback: $M = 3.61$, $SD = .89$), usefulness (outcome + process feedback: $M = 2.75$, $SD = 1.16$; task + outcome or task + process feedback: $M = 3.50$, $SD = 1.01$), accuracy (outcome + process feedback: $M = 3.01$, $SD = 1.12$; task + outcome or task + process feedback: $M = 3.75$, $SD = .95$), and trustworthiness (outcome + process feedback: $M = 2.92$, $SD = 1.26$; task + outcome or task + process feedback: $M = 3.64$, $SD = 1.01$). Thus, groups that received either outcome and task feedback or process and task feedback perceived the feedback to be more effective, useful, accurate, and trustworthy than groups that received the outcome and process feedback.

To further explore differences between groups that received combinations of two types of feedback, I used Contrast 6 to compare groups that received outcome and task feedback to groups that received process and task feedback. However, I did not observe any significant differences in participants' perceptions of overall feedback effectiveness (outcome + task feedback: $M = 3.58$, $SD = 1.07$; process + task feedback: $M = 3.65$, $SD = .68$), usefulness (outcome + task feedback: $M = 3.34$, $SD = 1.18$; process + task feedback:

M = 3.65, *SD* = .80), accuracy (outcome + task feedback: *M* = 3.87, *SD* = 1.05; process + task feedback: *M* = 3.62, *SD* = .83), or trustworthiness (outcome + task feedback: *M* = 3.62, *SD* = 1.21; process + task feedback: *M* = 3.66, *SD* = .78).

Subjective task complexity. To further examine the effects of the feedback manipulations, I examined the effects of outcome, process, and task feedback on subjective (e.g., perceived) task complexity (administered after Trial 1 and Trial 2). I used a repeated measures ANOVA approach to test the same set of six orthogonal contrasts described previously. Table 16 summarizes the results of these analyses. Unless otherwise noted, significant differences in contrasts were in the expected direction.

For Contrast 1, I did not find a significant difference between groups that received all three types of feedback (Time 1: *M* = 4.39, *SD* = 1.40; Time 2: *M* = 3.42, *SD* = 1.49) and groups that received only one type of feedback (Time 1: *M* = 4.46, *SD* = 1.02; Time 2: *M* = 3.72, *SD* = 1.17). However, results revealed a significant Trial by Contrast interaction effect. The univariate tests revealed that the contrast was not significant for perceived complexity at Time 1, $F(1, 215) = 0.07$, $p = .788$, but was it marginally significant at Time 2, $F(1, 215) = 3.54$, $p = .061$.

For Contrast 2, I did not find a significant difference in perceived task complexity between groups that received a combination of two types of feedback (Time 1: *M* = 4.55, *SD* = 1.16; Time 2: *M* = 4.06, *SD* = 1.30) and groups that received no feedback (Time 1: *M* = 4.20, *SD* = 1.14; Time 2: *M* = 3.68, *SD* = 1.15).

For Contrast 3, I did not find a significant difference in perceived task complexity between groups that received either only process or only outcome feedback (Time 1: *M* =

Table 16

Summary of Contrasts Testing for Differences in Subjective Task Complexity

Contrast Description	*F*	*p*
Between-Subjects Effects		
Contrast 1: 1 type vs. all feedback	0.88	.350
Contrast 2: 2 types vs. no feedback	2.00	.158
Contrast 3: O/P vs. T	0.81	.368
Contrast 4: O vs. P	3.05	.082
Contrast 5: O+T/P+T vs. O+P	0.04	.839
Contrast 6: O+T vs. O+P	4.71	.031
Within-Subjects Effects[1]		
Trial * Contrast 1	7.02	.008
Trial * Contrast 2	0.01	.913
Trial * Contrast 3	13.56	.000
Trial *Contrast 4	3.76	.053
Trial * Contrast 5	5.28	.022
Trial * Contrast 6	0.14	.702

Note. O = outcome feedback; P = process feedback; T = task feedback. $N = 216$.
[1] Multivariate test criteria are reported for within-subjects effects.

4.15, *SD* = 1.45; Time 2: *M* = 4.35, *SD* = 1.51) and groups that received only task feedback (Time 1: *M* = 4.86, *SD* = 1.17; Time 2: *M* = 4.14, *SD* = 1.47), but I found a significant Trial by Contrast interaction effect. The univariate tests revealed that there were significant differences in perceived complexity between the two groups at Time 1, $F(1, 215) = 6.06$, $p = .014$, but not at Time 2, $F(1, 215) = 0.48$, $p = .490$.

For Contrast 4, I did not find a significant difference in perceived task complexity between groups that received only outcome feedback (Time 1: *M* = 4.02, *SD* = 1.63; Time 2: *M* = 3.94, *SD* = 1.56) and groups that received only process feedback (Time 1: *M* = 4.29, *SD* = 1.27; Time 2: *M* = 4.77, *SD* = 1.36).

For Contrast 5, I did not find a significant difference in perceived task complexity between groups that received either outcome and task feedback or process and task feedback (Time 1: *M* = 4.63, *SD* = 1.04; Time 2: *M* = 3.94, *SD* = 1.20) and groups that received outcome and process feedback (Time 1: *M* = 4.40, *SD* = 1.38; Time 2: *M* = 4.29, *SD* = 1.49).

For Contrast 6, results revealed a significant difference in perceived complexity between groups that received outcome and task feedback (Time 1: *M* = 4.32, *SD* = .96; Time 2: *M* = 3.57, *SD* = 1.06) and groups that received process and task feedback (Time 1: *M* = 4.95, *SD* = 1.04; Time 2: *M* = 4.31, *SD* = 1.23). This difference was not in the expected direction, as perceptions of task complexity were higher for groups that received process and task feedback combinations.

Intrinsic motivation. I also examined the effects of the feedback manipulations on intrinsic motivation. Using repeated measures ANOVAs, I tested the same set of six orthogonal contrasts used for the previous manipulations checks for the intrinsic

motivation composite scale, as well as the perceived competence, intrinsic enjoyment, effort/importance, tension/pressure, and choice subscales (administered after Trial 1 and Trial 2). The results for these analyses are summarized in Table 17. Unless otherwise noted, significant differences in contrasts were in the expected direction.

For Contrast 1, results revealed significant differences in composite intrinsic motivation, perceived competence, intrinsic enjoyment, and perceived effort between groups that received all feedback types and groups that received only one feedback type. Specifically, participants who received all feedback types were more intrinsically motivated and had higher perceptions of competence, enjoyment, and effort than those who received only one type of feedback (see Table 18 for means and standard deviations of scale scores for each contrast group by administration). However, there were no significant differences between the two groups on the tension/pressure and choice subscales.

For Contrast 2, results revealed significant differences in composite intrinsic motivation, intrinsic enjoyment, and perceived effort between groups that did not received any feedback and groups that received two types of feedback. Specifically, participants who received two types of feedback were more intrinsically motivated and had higher perceptions of enjoyment and effort. In addition, there was a Trial by Contrast interaction effect for composite intrinsic motivation for this comparison. Univariate tests revealed that the differences in intrinsic motivation between the no feedback group and the two types of feedback groups was smaller in Time 1, $F(1, 215) = 7.09$, $p = .008$, and larger in Time 2, $F(1, 215) = 17.86$, $p = .000$. There were no

Table 17

Summary of Contrasts Testing for Differences in Intrinsic Motivation

	Intrinsic Motivation (Composite)		Perceived Competence		Intrinsic Enjoyment	
	F	*p*	*F*	*p*	*F*	*p*
Between-Subjects Effects						
Contrast 1: 1 type vs. all feedback	24.1	.000	19.0	.000	20.4	.000
Contrast 2: 2 types vs. no feedback	14.0	.000	2.5	.109	19.3	.000
Contrast 3: O/P vs. T	12.3	.000	3.0	.084	19.6	.000
Contrast 4: O vs. P	6.6	.010	7.6	.006	1.8	.176
Contrast 5: O+T/P+T vs. O+P	8.4	.004	4.8	.028	8.5	.004
Contrast 6: O+T vs. O+P	0.0	.891	0.5	.469	0.6	.430
Within-Subjects Effects[1]						
Trial * Contrast 1	1.5	.208	2.4	.117	0.2	.591
Trial * Contrast 2	5.3	.022	2.8	.092	3.5	.061
Trial * Contrast 3	5.1	.024	5.7	.017	1.2	.259
Trial * Contrast 4	0.0	.880	0.2	.625	0.4	.498
Trial * Contrast 5	2.0	.149	2.9	.087	0.6	.408
Trial * Contrast 6	0.0	.848	0.2	.625	0.0	1.00

Table 17 (continued)

	Effort/ Importance		Tension/ Pressure		Choice	
	F	*p*	*F*	*p*	*F*	*p*
Between-Subjects Effects						
Contrast 1: 1 type vs. all feedback	6.0	.014	3.2	.071	1.4	.225
Contrast 2: 2 types vs. no feedback	11.5	.000	0.6	.422	2.9	.086
Contrast 3: O/P vs. T	9.1	.002	2.2	.136	0.6	.413
Contrast 4: O vs. P	5.7	.017	0.0	.872	2.7	.096
Contrast 5: O+T/P+T vs. O+P	3.2	.073	0.9	.324	0.0	.985
Contrast 6: O+T vs. O+P	0.1	.669	0.1	.692	0.5	.469
Within-Subjects Effects[1]						
Trial * Contrast 1	1.3	.243	0.3	.528	0.9	.320
Trial * Contrast 2	1.6	.198	1.0	.301	1.2	.259
Trial * Contrast 3	0.2	.652	0.2	.611	1.3	.252
Trial * Contrast 4	0.6	.435	7.5	.006	0.2	.588
Trial * Contrast 5	2.9	.086	1.8	.170	1.1	.282
Trial * Contrast 6	1.8	.174	0.0	.836	0.2	.588

Note. O = outcome feedback; P = process feedback; T = task feedback. $N = 216$.
[1] Multivariate test criteria are reported for within-subjects effects.

Table 18

Means and Standard Deviations of Contrast Groups across Administrations of Intrinsic Motivation Measure

	Intrinsic Motivation				Perceived Competence				Intrinsic Enjoyment			
Contrast Group	Time 1		Time 2		Time 1		Time 2		Time 1		Time 2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Contrast 1												
All	4.26	0.63	4.36	0.66	3.71	1.04	4.24	1.23	3.96	0.97	2.24	1.23
1 type	3.49	0.76	3.42	0.91	2.83	1.26	2.88	1.60	2.76	1.38	2.69	1.52
Contrast 2												
None	3.46	0.78	3.29	0.81	2.92	1.19	3.06	1.24	2.49	1.14	2.29	1.14
2 types	3.94	0.99	4.10	1.02	3.07	1.36	3.73	1.51	3.50	1.56	3.72	1.57
Contrast 3												
O or P	3.34	0.73	3.14	0.80	2.80	1.29	2.59	1.58	2.37	1.05	2.21	1.22
T only	3.81	0.72	3.96	0.89	2.88	1.22	3.45	1.49	3.55	1.64	3.66	1.64
Contrast 4												
O only	3.62	0.59	3.41	0.76	3.19	1.32	3.07	1.59	2.65	1.12	2.40	1.11
P only	3.05	0.75	2.88	0.76	2.41	1.16	2.11	1.45	2.09	0.91	2.03	1.31
Contrast 5												
O+T/P+T	4.08	1.08	4.32	1.10	3.18	1.35	4.03	1.44	3.82	1.73	3.98	1.68
O+P	3.66	0.70	3.67	0.66	2.86	0.87	3.14	1.49	2.86	1.36	3.21	1.19
Contrast 6												
O+T	4.09	1.12	4.34	0.99	3.34	1.28	4.09	1.41	3.96	1.63	4.11	1.61
P+T	4.08	1.06	4.29	1.23	3.02	1.43	3.96	1.49	3.69	1.86	3.84	1.78

Table 18 (continued)

	Effort/ Importance				Tension/ Pressure				Choice			
Contrast Group	Time 1		Time 2		Time 1		Time 2		Time 1		Time 2	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Contrast 1												
All	4.37	0.81	4.51	0.73	5.28	1.08	5.21	1.03	3.97	1.29	4.12	1.54
1 type	3.89	1.33	3.73	1.51	4.69	1.46	4.70	1.50	3.75	1.53	3.56	1.80
Contrast 2												
None	3.61	1.34	3.39	1.17	5.14	1.40	4.91	1.31	3.81	1.56	3.44	1.67
2 types	4.31	1.49	4.43	1.27	4.82	1.43	4.74	1.45	4.17	1.50	4.18	1.75
Contrast 3												
O or P	3.63	1.30	3.43	1.41	4.84	1.43	4.87	1.48	3.72	1.66	3.40	1.96
T only	4.39	1.27	4.32	1.57	4.39	1.51	4.35	1.51	3.80	1.26	3.88	1.42
Contrast 4												
O only	3.95	1.18	3.87	1.40	4.93	1.28	4.72	1.38	4.11	1.74	3.67	1.98
P only	3.32	1.37	3.00	1.29	4.75	1.58	5.02	1.59	3.34	1.52	3.13	1.94
Contrast 5												
O+T/P+T	4.39	1.55	4.68	1.33	4.89	1.44	4.88	1.48	4.11	1.54	4.24	1.86
O+P	4.14	1.37	3.95	0.99	4.68	1.44	4.46	1.38	4.30	1.43	4.06	1.53
Contrast 6												
O+T	4.22	1.69	4.72	1.33	4.81	1.55	4.82	1.45	4.02	1.59	4.04	2.05
P+T	4.57	1.40	4.63	1.36	4.98	1.34	4.95	1.53	4.19	1.51	4.44	1.66

Note. O = outcome feedback; P = process feedback; T = task feedback. $N = 216$.

significant differences between the two groups on the perceived competence, tension/pressure, and choice subscales.

For Contrast 3, I observed significant differences in composite intrinsic motivation, intrinsic enjoyment, and perceived effort between groups that received only task feedback and groups that received only outcome feedback or only process feedback. Specifically, participants who received only task feedback were more intrinsically motivated and had higher perceptions of enjoyment and effort than participants who received either only outcome feedback or only process feedback. In addition, there was a Trial by Contrast interaction effect for composite intrinsic motivation for this comparison. Univariate tests revealed that the differences in intrinsic motivation between the only task feedback group and the only outcome or process feedback groups were smaller in Time 1, $F(1, 215) = 6.03$, $p = .014$, and larger in Time 2, $F(1, 215) = 16.05$, $p = .000$. Although there were no significant differences between the two groups for perceived competence, tension/pressure, and choice, I did observe a significant Trial by Contrast interaction effect for perceived competence. Univariate tests revealed that the differences in perceived competence were not significant for Time 1, $F(1, 215) = 0.07$, $p = .787$ but were significant for Time 2, $F(1, 215) = 6.53$, $p = .011$.

For Contrast 4, I observed significant differences in composite intrinsic motivation, perceived competence, and perceived effort between groups that received only outcome feedback and groups that received only process feedback. These effects were not in the expected directions, as I expected process feedback to be associated with higher perceived competence and effort. However, participants who received only outcome feedback were more intrinsically motivated and had higher perceptions of

competence and effort. Although there were no significant differences between the two groups on the intrinsic enjoyment, tension/pressure, and choice subscales, I did observe a significant Trial by Contrast interaction effect for tension/pressure.

For Contrast 5, I observed significant differences in composite intrinsic motivation, perceived competence, and intrinsic enjoyment between groups that received process and outcome feedback and groups that received either outcome and task feedback or process and task feedback. That is, participants who received a combination of process or outcome feedback with task feedback were more intrinsically motivated and had higher perceptions of competence and enjoyment than participants who received process and outcome feedback. However, there were no significant differences between the two groups on the perceived effort, tension/pressure, and choice subscales.

For Contrast 6, I did not observe any significant differences between groups that received outcome and task feedback and groups that received process and task feedback for the composite scale or the five subscales.

Description of Analyses

Repeated measures ANOVAs with alpha levels of .05 were used to test all hypotheses, and Type III sums of squares are reported, unless otherwise noted. I used task performance scores for Trials 3 through Trial 6 as dependent variables in the repeated measures ANOVAs. The scores from Trial 1 and Trial 2 were excluded from the analyses (as dependent variables) as they were considered practice trials. Due to the uneven distribution of ability across conditions, I included cognitive ability and its two-way interactions with each of the feedback main effects in the model. Ability was not included in higher-order interactions because preliminary analyses revealed that ability

was involved only as a main effect and as a component of two-way interactions involving the feedback manipulations.

Outcome, Process, and Task Feedback Effects

In Hypothesis 1, I predicted a significant interaction between process feedback effects and task feedback effects on task performance. Table 19 summarizes the results of the analyses. As Table 19 indicates, although the analyses did not reveal a significant two-way interaction, $F(1, 204) = 0.23$, $p = .634$, a main effect for task feedback was observed, $F(1, 204) = 6.72$, $p = .010$. Task performance was significantly higher in the presence of task feedback ($M = 26.0$, $SD = 24.25$) relative to when task feedback was not present ($M = 127.46$, $SD = 70.59$). (Note: Lower scores indicate fewer guesses and, thus, better performance). Upon examination of the within-subjects effects, I observed a significant interaction for Trial by Outcome Feedback, $\lambda = .95$, $F(3, 202) = 3.36$, $p = .019$. In addition, results revealed a significant interaction for Trial by Process Feedback by Task Feedback, $\lambda = .93$, $F(3, 202) = 4.86$, $p = .003$, and for Trial by Outcome Feedback by Task Feedback, $\lambda = .96$, $F(3, 202) = 2.81$, $p = .040$.

To follow-up the Trial by Process Feedback by Task Feedback and the Trial by Outcome Feedback by Task Feedback interactions, I examined the effects of outcome and process feedback within conditions that received task feedback and conditions that did not receive task feedback. Results failed to reveal a significant Trial by Process Feedback interaction in either the task feedback, $\lambda = .97$, $F(3, 99) = 0.67$, $p = .566$, or no task feedback conditions, $\lambda = .96$, $F(3, 99) = 1.12$, $p = .340$ (see Figure 1). Because the traditional follow-up tests failed to capture the nature of the interaction, I conducted a post hoc test of all differences between means, using the Tukey HSD method to adjust for

Table 19

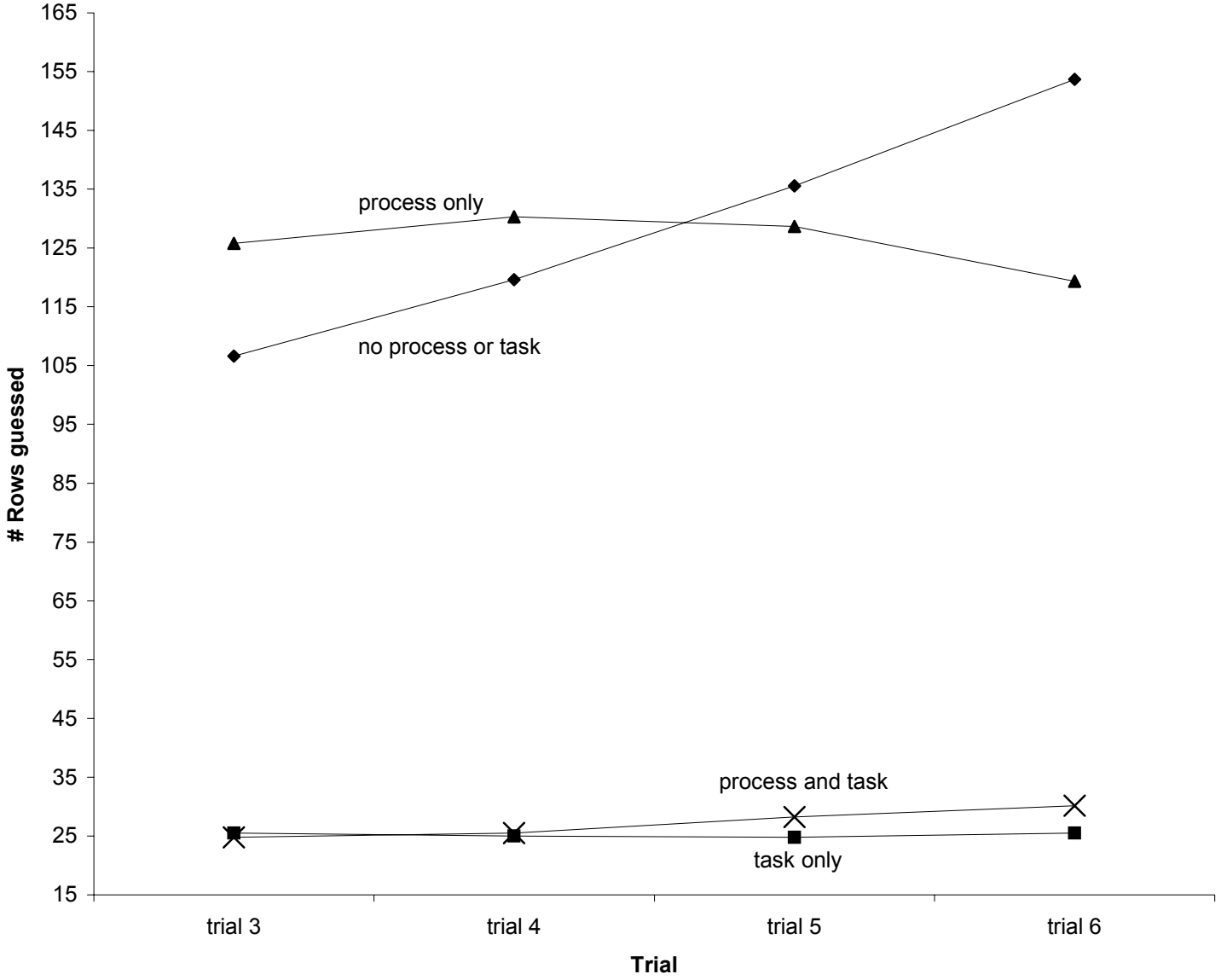
Process, Outcome, and Task Feedback Effects on Task Performance (Trial 3 – Trial 6)

Source	*df*	λ	*F*	*p*
Between-Subjects Effects				
Ability	1		1.44	.232
Outcome Feedback	1		0.39	.533
Process Feedback	1		3.11	.079
Task Feedback	1		6.72	.010
Ability * Outcome	1		0.34	.563
Ability * Process	1		3.69	.056
Ability * Task	1		1.36	.245
Outcome * Process	1		0.81	.368
Outcome * Task	1		0.98	.323
Process * Task	1		0.23	.634
Outcome * Process * Task	1		1.74	.189
Error	204			
Within-Subjects Effects[1]				
Trial	3	0.98	1.07	.363
Trial * Ability	3	0.98	1.22	.305
Trial * Outcome	3	0.95	3.36	.019
Trial * Process	3	0.99	0.59	.624
Trial * Task	3	0.98	1.30	.274
Trial * Ability * Outcome	3	0.97	2.37	.072

Table 19 (continued)

Source	*df*	λ	*F*	*p*
Trial * Ability * Process	3	0.99	0.27	.844
Trial * Ability * Task	3	0.98	1.58	.194
Trial * Outcome * Process	3	0.97	2.37	.072
Trial * Outcome * Task	3	0.96	2.81	.040
Trial * Process * Task	3	0.93	4.86	.003
Trial * Outcome * Process * Task	3	0.97	1.98	.118
Error	202			

[1] Multivariate test criteria are reported for within-subjects effects.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45
35
25
15
Rows guessed
process only
no process or task
process and task
task only
trial 3
trial 4
trial 5
trial 6
Trial

multiple comparisons. I found significant differences between Trial 3 and Trial 6, $t(26) = -2.22$, $p = .035$, Trial 4 and Trial 5, $t(26) = -2.65$, $p = .013$, and Trial 4 and Trial 6, $t(26) = -3.63$, $p = .001$ in conditions that did not received either process or task feedback. I also found a significant difference between the conditions receiving process feedback, but no task feedback and the conditions that did not receive either process or task feedback at Trial 6, $t(26) = -2.27$, $p = .027$.

With respect to outcome feedback, results revealed a significant Trial by Outcome Feedback interaction for the no task feedback conditions, $\lambda = .90$, $F(3, 99) = 3.29$, $p = .023$, but not in the task feedback conditions, $\lambda = .98$, $F(3, 99) = 0.37$, $p = .771$. Thus, the negative effect of outcome feedback differed across trials for the no task feedback conditions, but not for the task feedback conditions (see Figure 2). Examination of the univariate tests for the no task feedback conditions revealed a significant negative effect of outcome feedback only in Trial 4, $F(1, 101) = 4.08$, $p = .046$.

Interactive Effects of Feedback Types and External Feedback Propensity

For Hypothesis 2, I predicted that the process feedback effects on performance would be moderated by external feedback propensity. Specifically, I expected to observe more beneficial effects for process feedback for those participants high in external feedback propensity. Consistent with the previous analysis, I examined the effects of external feedback propensity using a repeated measures ANOVA. Table 20 summarizes the results from this analysis. As indicated, there was not a significant interaction between process feedback and external feedback propensity for the original measure, $F(1, 195) = 1.51$, $p = .219$. However, effects for external feedback propensity were observed in the form of a significant Trial by External Feedback Propensity effect, $\lambda = .94$, $F(3,$

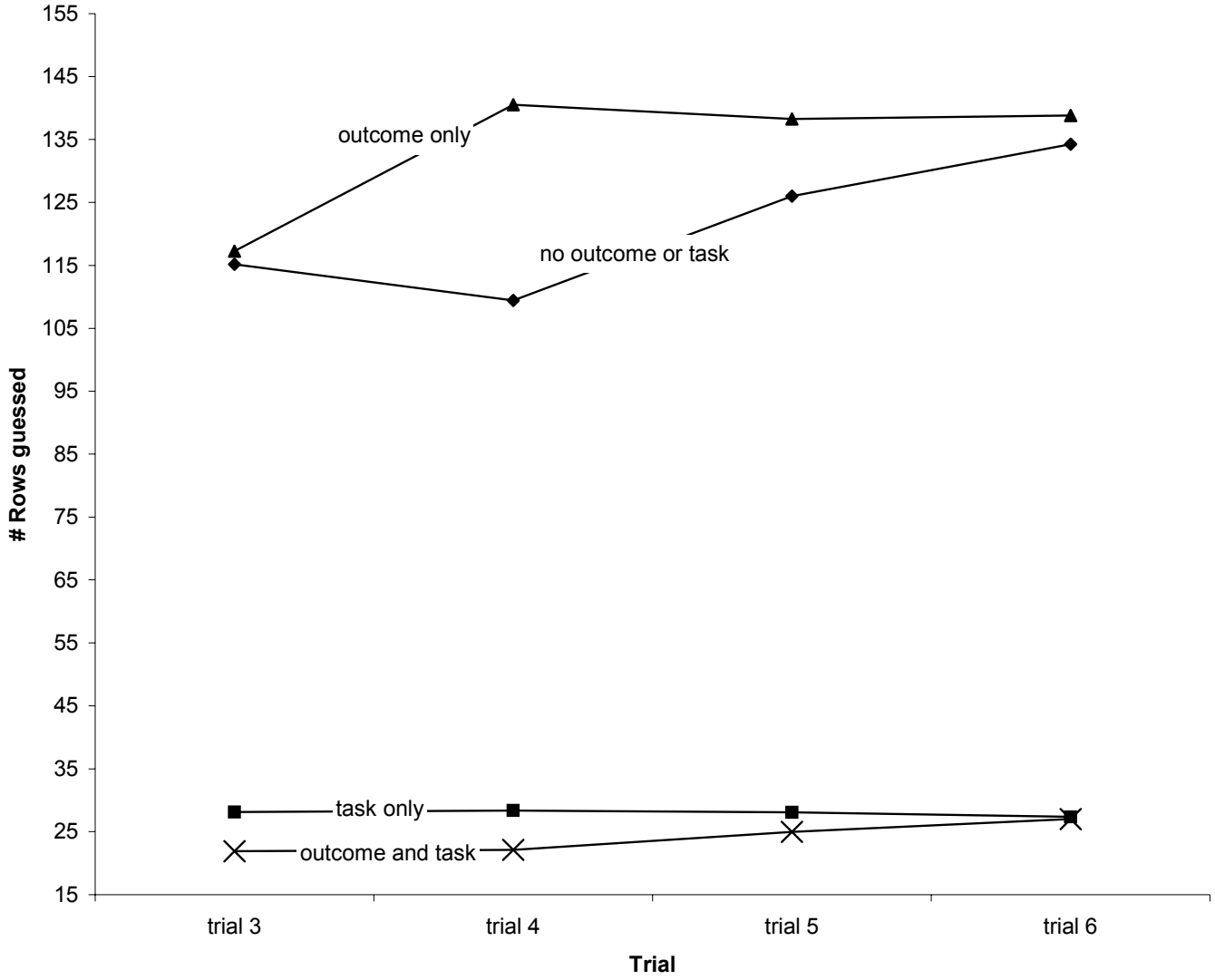
155
145
135
125
115
105
95
85
75
65
55
45
35
25
15
Rows guessed
outcome only
no outcome or task
task only
outcome and task
trial 3
trial 4
trial 5
trial 6
Trial

Table 20

Feedback Effects on Performance with External Feedback Propensity (Original Scale)

Source	*df*	λ	*F*	*p*
Between-Subjects Effects				
Ability	1		0.88	.349
Outcome Feedback	1		1.23	.269
Process Feedback	1		0.06	.803
Task Feedback	1		2.64	.106
External feedback propensity (FP)	1		0.75	.387
Ability * Outcome	1		0.45	.505
Ability * Process	1		4.24	.040
Ability * Task	1		2.34	.128
Ability * External FP	1		1.13	.288
Outcome * Process	1		0.04	.839
Outcome * Task	1		1.98	.161
Process * Task	1		1.12	.291
Outcome * Process * Task	1		0.02	.902
External FP * Outcome	1		2.47	.117
External FP * Process	1		1.51	.219
External FP * Task	1		0.63	.429
External FP * Outcome * Process	1		0.01	.915
External FP * Outcome * Task	1		2.21	.139
External FP * Process * Task	1		0.94	.333
External FP * Outcome * Process * Task	1		0.09	.766
Error	195			

Table 20 (continued)

Source	*df*	λ	*F*	*p*
Within-Subjects Effects[1]				
Trial	3	0.94	3.47	.017
Trial * Ability	3	0.95	3.07	.029
Trial * Outcome	3	0.95	3.27	.022
Trial * Process	3	0.98	1.24	.295
Trial * Task	3	0.99	0.40	.747
Trial * External FP	3	0.94	3.95	.009
Trial * Ability * Outcome	3	0.96	2.58	.054
Trial * Ability * Process	3	0.99	0.37	.770
Trial * Ability * Task	3	0.97	1.43	.234
Trial * Ability * External FP	3	0.94	3.47	.017
Trial * Outcome * Process	3	0.96	2.42	.066
Trial * Outcome * Task	3	0.98	0.84	.471
Trial * Process * Task	3	0.98	1.26	.288
Trial * Outcome * Process * Task	3	0.97	1.88	.134
Trial * External FP * Outcome	3	0.97	1.36	.255
Trial * External FP * Process	3	0.98	1.11	.346
Trial * External FP * Task	3	0.98	0.96	.411
Trial * External FP * Outcome * Process	3	0.96	2.58	.054
Trial * External FP * Outcome * Task	3	0.98	0.89	.442
Trial * External FP * Process * Task	3	0.98	0.76	.515
Trial * External FP * Outcome * Process * Task	3	0.97	1.79	.148
Error	193			

[1] Multivariate test criteria are reported for within-subjects effects.

193) = 3.95, p = .009, indicating an emerging effect of external feedback propensity on performance across time. In addition, I found a significant Trial by Ability by External Feedback Propensity Effect, λ = .94, F(3, 193) = 3.47, p = .017. Because none of the external feedback propensity effects interacted with the feedback manipulations, no follow-up tests were conducted.

I reexamined Hypothesis 2 by using the data obtained with the revised external feedback propensity measure. I developed the revised feedback propensities measures in order to improve the strength of the psychometric properties of the original scales and to increase the relevance of the original scales to the feedback used in the current study (see page 23 in Method section). Consistent with the previous analyses, I used repeated measures ANOVAs to examine the effects of the feedback manipulations and external feedback propensity on task performance. Once again, I predicted a significant interaction between process feedback and external feedback propensity. Table 21 summarizes the results from this analysis. As indicated, there was not a significant interaction between process feedback and external feedback propensity for the revised measure, F(1, 195) = 1.23, p = .269. Thus, Hypothesis 2 was not supported: process feedback effects on task performance did not differ depending on level of external feedback propensity for either the original or the revised measure.

However, results revealed a significant Trial by Outcome by Task Feedback effect, a significant Trial by External Feedback Propensity by Outcome Feedback effect and a significant Trial by External Feedback Propensity by Outcome by Task Feedback effect. Univariate tests indicated that the External Feedback Propensity by Outcome by

Table 21

Feedback Effects on Performance with External Feedback Propensity (Revised Scale)

Source	*df*	λ	*F*	*p*
Between-Subjects Effects				
Ability	1		0.94	.334
Outcome Feedback	1		1.81	.179
Process Feedback	1		2.96	.089
Task Feedback	1		0.84	.361
External feedback propensity (FP)	1		0.59	.442
Ability * Outcome	1		0.29	.592
Ability * Process	1		4.22	.041
Ability * Task	1		1.36	.244
Ability * External FP	1		0.66	.417
Outcome * Process	1		1.67	.198
Outcome * Task	1		1.19	.276
Process * Task	1		0.40	.530
Outcome * Process * Task	1		0.08	.774
External FP * Outcome	1		2.93	.088
External FP * Process	1		1.23	.269
External FP * Task	1		0.00	.996
External FP * Outcome * Process	1		2.06	.153
External FP * Outcome * Task	1		1.55	.215
External FP * Process * Task	1		0.51	.477
External FP * Outcome * Process * Task	1		0.01	.932
Error	195			

Table 21 (continued)

Source	*df*	λ	*F*	*p*
Within-Subjects Effects[1]				
Trial	3	0.99	0.40	.747
Trial * Ability	3	0.99	0.22	.879
Trial * Outcome	3	0.96	1.99	.115
Trial * Process	3	0.98	1.19	.312
Trial * Task	3	0.99	0.42	.735
Trial * External FP	3	0.99	0.60	.615
Trial * Ability * Outcome	3	0.97	1.75	.157
Trial * Ability * Process	3	0.98	0.69	.554
Trial * Ability * Task	3	0.97	1.81	.145
Trial * Ability * External FP	3	0.99	0.37	.773
Trial * Outcome * Process	3	0.97	1.82	.144
Trial * Outcome * Task	3	0.95	2.78	.041
Trial * Process * Task	3	0.98	1.04	.375
Trial * Outcome * Process * Task	3	0.96	2.37	.071
Trial * External FP * Outcome	3	0.95	3.28	.021
Trial * External FP * Process	3	0.98	0.80	.494
Trial * External FP * Task	3	0.98	0.79	.499
Trial * External FP * Outcome * Process	3	0.97	1.98	.117
Trial * External FP * Outcome * Task	3	0.95	2.79	.041
Trial * External FP * Process * Task	3	0.98	0.74	.524
Trial * External FP * Outcome * Process * Task	3	0.96	2.54	.057
Error	193			

[1] Multivariate test criteria are reported for within-subjects effects.

Task Feedback interaction was significant only in Trial 6, $F(1, 195) = 5.03$, $p = .026$, suggesting an emerging interaction effect.

To further examine this interaction, I conducted post hoc analyses within the task feedback and no task feedback conditions. Consistent with previous analyses, I examined the effects of external feedback propensity, outcome feedback and process feedback within conditions that received task feedback and conditions that did not receive task feedback. Results revealed a significant Trial by External Feedback Propensity by Outcome feedback interaction for the no task feedback conditions, $\lambda = .91$, $F(3, 94) = 3.04$, $p = .032$, but not for the task feedback conditions, $\lambda = .99$, $F(3, 94) = 0.05$, $p = .981$. Thus, I conducted further post hoc analyses within the outcome feedback and no outcome feedback conditions. Results did not reveal a significant Trial by External Feedback Propensity interaction for the outcome/no task feedback conditions, $\lambda = .93$, $F(3, 45) = 1.10$, $p = .357$, or the no outcome/no task feedback conditions, $\lambda = .96$, $F(3, 45) = 0.62$, $p = .602$.

Interactive Effects of Internal Feedback Propensity and Initial Performance

For Hypothesis 3, I predicted that effects of internal feedback propensity on task performance would be moderated by initial task performance. Initial task performance was the mean performance for Trials 1 and 2. Using a repeated measures ANOVA, I examined the effects of initial task performance and internal feedback propensity on task performance. (Note: Type I sums of squares were used in analyses for Hypothesis 3 to reduce multicolinearity effects). I expected to observe a significant interaction between initial task performance and internal feedback propensity. I predicted that task performance would be negatively influenced by internal feedback propensity only when

initial task performance was poor. To be consistent with the previous analyses, I modeled ability in the main effects of internal feedback propensity and initial performance. Table 22 displays the results of this analysis. Results revealed that, although there were significant main effects of initial task performance, $F(1, 209) = 273.72$, $p = .000$, and internal feedback propensity, $F(1, 209) = 4.77$, $p = .030$, initial task performance did not interact with internal feedback propensity in its effects on task performance, $F(1, 209) = 1.58$, $p = .210$. Thus, higher internal feedback propensity and higher initial performance were associated with better performance, but these effects did not interact.

I conducted additional repeated measures ANOVAs to further examine the effects of internal feedback propensity, using the data obtained with the revised internal feedback propensity measure. Table 23 summarizes the results from this analysis. When the revised internal feedback propensity data were used in the analysis, I found a significant main effect of initial performance, $F(1, 209) = 274.19$, $p = .000$, but no interaction between initial performance and internal feedback propensity, $F(1, 209) = 0.01$, $p = .925$. However, I observed a significant Trial by Internal Feedback Propensity effect, $\lambda = .93$, $F(3, 207) = 3.42$, $p = .018$, indicating that the effects of internal feedback propensity on performance differed across trials. In addition, I found a significant Trial by Initial Performance by Internal Feedback Propensity effect, $\lambda = .93$, $F(3, 207) = 3.21$, $p = .023$.

To further examine the Trial by Initial Performance by Internal Feedback Propensity interaction, I conducted a median split to classify participants into high initial performance and low initial performance groups. The median performance score for

Table 22

Effects of Internal Feedback Propensity (Original Scale) and Initial Task Performance (mean of Trials 1 &2) on Task Performance (Trial 3 – Trial 6)

Source	*df*	λ	*F*	*p*
Between-Subjects Effects				
Ability	1		12.92	.000
Internal feedback propensity (FP)	1		4.77	.030
Initial performance	1		273.72	.000
Ability * Internal FP	1		2.66	.104
Ability + Initial performance	1		0.00	.966
Internal FP * Initial performance	1		1.58	.210
Error	209			
Within-Subjects Effects[1]				
Trial	3	0.96	2.27	.080
Trial * Ability	3	0.98	1.24	.295
Trial * Internal FP	3	0.99	0.46	.704
Trial * Initial performance	3	0.99	0.27	.846
Trial * Ability * Internal FP	3	0.96	2.55	.056
Trial * Ability * Initial performance	3	0.96	2.46	.063
Trial * Internal FP * Initial performance	3	0.97	2.11	.099
Error	207			

Note. Type I sums of squares were used in analyses due to increased multicolinearity.
[1] Multivariate test criteria are reported for within-subjects effects.

Table 23

Effects of Internal Feedback Propensity (Revised Scale) and Initial Task Performance (mean of Trials 1 & 2) on Task Performance (Trial 3 – Trial 6)

Source	*df*	λ	*F*	*p*
Between-Subjects Effects				
Ability	1		12.76	.000
Internal feedback propensity (FP)	1		1.69	.195
Initial performance	1		274.19	.000
Ability * Internal FP	1		0.17	.678
Ability * Initial performance	1		0.50	.480
Internal FP * Initial performance	1		0.01	.925
Error	209			
Within-Subjects Effects[1]				
Trial	3	0.96	2.26	.082
Trial * Ability	3	0.98	1.28	.280
Trial * Internal FP	3	0.95	3.42	.018
Trial * Initial performance	3	0.99	0.33	.803
Trial * Ability * Internal FP	3	0.99	0.67	.570
Trial * Ability * Initial performance	3	0.94	4.11	.007
Trial * Internal FP * Initial performance	3	0.95	3.21	.023
Error	207			

Note. Type I sums of squares were used in analyses due to increased multicolinearity.
[1] Multivariate test criteria are reported for within-subjects effects.

initial performance was 41.5 rows. Out of 216 participants, 109 were classified as high initial performers and 106 were classified as poor initial performers. Then, I conducted separate repeated measures ANOVAs to examine the effects of internal feedback propensity on performance within the high and low initial performance groups. Tables 24 and 25 summarize the results from the analyses. As indicated, I found a larger effect for the Trial by Internal Feedback Propensity interaction for the low initial performance group, $\lambda = .92$, $F(3, 101) = 2.56$, $p = .058$, than the high initial performance group, $\lambda = .97$, $F(3, 103) = 0.93$, $p = .428$. These data suggest that the effect of internal feedback propensity on performance differed across trials for individuals with poor initial performance but not for individuals with high initial performance. Univariate tests for individuals with low initial performance showed that the positive effect of internal feedback propensity on task performance increased from Trial 3, $F(1, 103) = 0.03$, $p = .858$ to Trial 4, $F(1, 103) = 3.81$, $p = .053$, but then decreased again in Trial 5, $F(1, 103) = 1.03$, $p = .311$ and Trial 6, $F(1, 103) = 0.05$, $p = .824$. However, the effect of internal feedback propensity on task performance for individuals with high initial performance did not change significantly across trials (Trial 3: $F(1, 105) = 1.48$, $p = .227$; Trial 4: $F(1, 105) = 1.19$, $p = .278$; Trial 5: $F(1, 105) = 0.46$, $p = .500$; Trial 6: $F(1, 105) = 0.01$, $p = .910$).

Discussion

The purpose of the present study was to examine the effects of feedback types (i.e., outcome, process, and task feedback), feedback propensities, and their interactions on task performance in an attempt to determine, first, which types of feedback produced

Table 24

Effects of Internal Feedback Propensity (Revised Scale) on Task Performance (Trial 3 – Trial 6) for High Initial Performance Group

Source	*df*	λ	*F*	*p*
Between-Subjects Effects				
Ability	1		4.89	.029
Internal feedback propensity (FP)	1		0.52	.474
Ability * Internal FP	1		0.02	.899
Error	105			
Within-Subjects Effects[1]				
Trial	3	0.95	1.65	.182
Trial * Ability	3	0.98	0.37	.773
Trial * Internal FP	3	0.97	0.93	.428
Trial * Ability * Internal FP	3	0.98	0.53	.658
Error	103			

Note. $N = 109$. Type I sums of squares were used in analyses due to increased multicolinearity.

[1] Multivariate test criteria are reported for within-subjects effects.

Table 25

Effects of Internal Feedback Propensity (Revised Scale) on Task Performance (Trial 3 – Trial 6) for Low Initial Performance Group

Source	*df*	λ	*F*	*p*
Between-Subjects Effects				
Ability	1		0.07	.787
Internal feedback propensity (FP)	1		0.91	.342
Ability * Internal FP	1		0.62	.433
Error	103			
Within-Subjects Effects[1]				
Trial	3	0.96	1.09	.354
Trial * Ability	3	0.96	1.17	.321
Trial * Internal FP	3	0.92	2.56	.058
Trial * Ability * Internal FP	3	0.99	0.32	.809
Error	101			

Note. $N = 107$. Type I sums of squares were used in analyses due to increased multicolinearity.

[1] Multivariate test criteria are reported for within-subjects effects.

better task performance and, second, how feedback propensities influenced relationships between feedback type and performance.

First, I predicted that process feedback and task feedback would interact in their effects on task performance. Further, I predicted that external feedback propensity and process feedback would interact in their effects on performance. Finally, I predicted that initial task performance would moderate the effects of internal feedback propensity on task performance.

Effects of Outcome, Process, and Task Feedback

I did not find a significant interaction between process and task feedback; thus, Hypothesis 1 was not supported. Results showed that task feedback was the only feedback type that demonstrated a significant beneficial effect on performance. This finding is consistent with previous research (e.g., Goodman, 1998). Goodman (1998) found that subjects who received high task feedback outperformed those who received low task feedback regardless of the amount of external feedback provided. Similarly, in the current study, task feedback showed a large effect on task performance relative to the effects of either outcome or process feedback. These results demonstrate the importance of task feedback, especially in a novel, complex task environment.

Moreover, the effects of task feedback overshadow the effects of the external feedback types examined in this study. Perhaps, task conditions with low task feedback place greater demands on attentional resources because individuals do not have enough resources for performance monitoring and strategy formation. Moreover, task feedback has been found to improve performance due to its effects on error detection and correction skills (Goodman, 1998). According to the MPCL paradigm, feedback must

provide error correction information in order to facilitate learning (Hammond et al., 1980). Without adequate resources for the processes needed to learn the task, individuals may become frustrated and cease trying to learn the task.

I expected process feedback to direct attention to task-relevant cues and to promote a more focused information search, resulting in improved task-performance strategies. I predicted that process feedback would facilitate better strategy development and supplement the information provided by task feedback, resulting in better performance. However, the addition of process feedback to task feedback did not significantly improve performance. At the early stages of skill acquisition, substantial demands on cognitive resources are imposed on individuals, requiring them to devote much of their attention to understanding and performing the task (Kanfer & Ackerman, 1989). When external feedback (i.e., process and outcome) was presented in the presence of task feedback, external and task feedback may have competed for limited cognitive resources, leading to interference in processing of information from one or both sources of feedback (Goodman, 1998). Because individuals were at the early stages of skill acquisition, individuals may have focused on processing task feedback, the most useful feedback type, at the expense of processing the outcome or process feedback.

Although Hypothesis 1 was not supported, I did observe two related and interesting findings. First, the Trial by Process by Task Feedback Interaction revealed that in the absence of task feedback, individuals who received process feedback improved slightly after Trial 5 compared to individuals who did not received process feedback, whose performance continued to decline across trials (see Figure 1). A possible explanation of the Trial by Process by Task Feedback Interaction may be provided by

Kluger and DeNisi's (1996) feedback intervention theory (FIT). They identify three levels of processes involved in the regulation of task performance. The highest level, meta-task processes, serves as a mode for resolving feedback-self discrepancies and is associated with affective processes, resulting in depletion of cognitive resources needed for task performance. The intermediate level is task-motivation processes. To the extent that task-motivation processes are unable to resolve feedback-standard discrepancy, attention will be diverted to either higher-level processes (meta-task) or lower level processes, referred to as task-learning processes. Task-learning processes function to deal with discrepancies through behavior change (e.g., activating programs or scripts for action) and are activated directly by cues provided by feedback. Researchers have suggested that process feedback provides a cueing function for learning and strategy implementation (Earley et al., 1990; Nadler, 1979).

Considering Kluger and DeNisi's (1996) FI theory, directing attentional resources to the task processes should result in enhanced learning. The cueing function included in process feedback may help facilitate learning, resulting in enhanced performance on complex task. However, the beneficial effects of process feedback may not emerge during the early stages of skill acquisition when individuals do not have enough attentional resources to devote to attending to and processing such process feedback information. As previously mentioned, when cognitive resources are limited, individuals may attend only to the most important information needed for task completion (e.g., task feedback) at the expense of attention to process feedback.

The first phase of skill acquisition, declarative knowledge, involves understanding task requirements (Anderson, 1985) and requires substantial attentional resources (Kanfer

& Ackerman, 1989). With practice, individuals begin to integrate the knowledge for each task component through knowledge compilation (Anderson, 1985). During this phase, less attentional resources are required (Kanfer & Ackerman, 1989). In the final phase, individuals have acquired procedural knowledge as task execution becomes more automatic and requires less attention. Thus, during the early stages of skill acquisition, when attentional demands are high, the learning cues provided by process feedback may not be as effective. After individuals have progressed into the later stages of skill acquisition, resources required for task objectives and procedures are reduced, allowing for processing learning cues and strategy development. This may explain why the positive effects of process feedback did not emerge until the final trials because individuals were in the later stages of skill acquisition.

Second, I found that the effects of outcome feedback differed across trials for the no task feedback conditions but not for the task feedback conditions. This interaction was likely due to the performance drop from Trial 3 to Trial 4 for individuals who received only outcome feedback (see Figure 2). Although not significant, outcome feedback had a negative effect on task performance. As shown in Figure 2, individuals who received outcome feedback only consistently performed poorly across trials, even when compared to individuals who did not receive outcome or task feedback. These results are consistent with previous research involving outcome feedback and complex task environments. The detrimental effect of outcome feedback on complex task performance has been well-documented (e.g., Balzer et al, 1989; Early et al., 1990; Hamond & Summers, 1972; Jacoby et al., 1984). Multiple-cue probability learning (MPCL) research (e.g., Balzer et al., 1989) has indicated that the presence of outcome

feedback during complex task execution may hinder learning because individuals use dysfunctional or suboptimal task strategies. Feedback must provide error correction information in order to facilitate learning, and because outcome feedback does not provide this type of information, it should not improve learning (Kluger & DeNisi, 1996). Furthermore, because outcome feedback emphasizes performance outcomes, it may divert attentional resources away from the task and direct attention toward the self, or meta-task processes (Kluger & DiNisi, 1996). Meta-task processes may prompt affective processes (e.g., self-esteem, control, impression management) and deplete cognitive resources, which results in detrimental effects for performance.

Effects of Feedback Types and External Feedback Propensity

For Hypothesis 2, I predicted that external feedback propensity would moderate the effects of process feedback on task performance. Specifically, process feedback was expected to have a stronger effect for those individuals with a high external feedback propensity than for those individuals with a low external feedback propensity. High external feedback propensity was expected to be particularly beneficial for initial skill acquisition when combined with process feedback because these individuals were expected to attend closely to the process information provided, resulting in optimal strategy development and enhanced performance. However, I did not find support for this hypothesis. For the analyses involving the original external feedback propensity measure created by Herold and colleagues (e.g., Fedor, et al., 1992; Herold & Parsons, 1985; Herold et al., 1996), I did not find any significant effects involving external feedback propensity and feedback types.

However, the original measure is more related to preference for externally-mediated feedback from other *people (*e.g., supervisors, peers), whereas the current study examined computer-mediated external feedback. Thus, results involving the data obtained from the revised external feedback measures may be more relevant to this study. However, I did not find a significant interaction between process and external feedback propensity using the revised data. Thus, Hypothesis 2 was not supported. External feedback propensity may be linked more closely to feedback provided by others. To the extent that external feedback propensity has a social component, the computer-mediated external feedback may not be salient for those individuals with external feedback propensity, compared to external feedback given by another person (e.g., supervisor). Thus, these participants may not perceive the computer-mediated feedback as external feedback because the social component is not present. Further examination of external feedback propensity is needed to fully understand the meaning of this construct. The results of the current study suggest that perhaps external feedback propensity may not simply be a preference for external feedback, but more specifically, a preference for feedback from other individuals.

Although I did not find support for Hypothesis 2, I did find a Trial by External Feedback Propensity by Outcome by Task interaction effect in the analysis with the revised external feedback propensity measure. As previously mentioned, I found a significant Trial by External Feedback Propensity by Outcome Feedback interaction for the no task feedback conditions. Unfortunately, the follow-up analysis failed to reveal a significant Trial by External Feedback Propensity interaction for either the outcome feedback conditions or no outcome feedback conditions.

Effects of Internal Feedback Propensity and Initial Performance

For Hypothesis 3, I predicted that initial task performance would moderate the effects of internal feedback propensity on task performance. Specifically, high internal feedback propensity was expected to negatively affect overall task performance for individuals with poor initial performance and positively affect overall task performance for individuals with high initial performance. Individuals high in internal feedback propensity may ignore or deny external feedback that is necessary for task mastery of novel tasks (Herold & Fedor, 1998; 2003), thus may perform poorly during the initial stages of skill acquisition. However, I proposed that the consequences of inattention to external cues would depend on the actual performance of the individual because individuals may differ in their abilities to effectively derive task information from the task or to self-assess their own performance. Individuals performing well during practice trials may be able to derive enough information from the task and would not need external feedback cues to effectively perform the task. In contrast, individuals who are performing poorly may not be deriving enough information from the task or themselves and a high internal feedback propensity may be detrimental because they disregard external feedback needed for effective skill acquisition.

Results from the original internal feedback measure did not reveal a significant Internal Feedback Propensity by Initial Performance interaction. However, it was interesting to find that internal feedback propensity was significantly positively related to performance. This is not consistent with previous research involving internal feedback propensity. Past research has found internal feedback propensity to be negatively related to initial training performance (Fedor et al., 1992; Herold et al., 1991) and the number of

trials and hours required to finish the training program (Herold & Fedor, 1998). However, most of the past research used similar flight simulator tasks, which is quite different from the problem-solving task used in the current study. Results from the revised internal feedback propensity measure revealed a significant Trial by Internal Feedback Propensity by Initial Performance interaction. Post hoc analyses revealed that the effects of internal feedback propensity on performance increases across trials for poor initial performers but not for good initial performers.

Limitations and Future Research

The use of an experimental simulation to test my hypotheses raises the obvious question of whether these results will generalize to other more natural settings and other sources. This study uses a computer as the feedback source, which is becoming more common given the prevalence of computerized training and computer-based tasks. However, I cannot infer that computer-mediated feedback and feedback from human sources operates similarly. Other factors become salient when a human source provides feedback, such as motivation of the source (Ilgen et al., 1979) and source credibility (Fedor, 1991). In addition, external feedback propensity may have a social component, meaning individuals with external feedback propensities seek and prefer feedback given from another person, not just computerized feedback. Thus, future researchers should consider feedback from multiple external feedback sources and compare the interactive effects of feedback propensities and feedback type on performance.

Another feedback source not assessed in this study is feedback from oneself. Researchers (e.g., Ashford, 1989) have examined the advantages of using self-assessments in organizations. It may be that individuals with internal feedback

propensities would benefit more from this type of feedback. Future researchers should examine the effects of self-assessments and other self-mediated feedback on performance and its interactive effects with internal feedback propensity.

The process feedback used in this study depended on the task condition, not the performance of the participant. Therefore, participants were not receiving process feedback based on their actual performance but feedback based on the most effective ways to perform the task. Whereas the process feedback used in this study may be more efficient, it could cause delays in performance for individuals who are using a problem-solving strategy different from the strategy suggested by the feedback. This presents further problems when certain strategies work better for some individuals than other individuals. Thus, process feedback tailored to the individual's performance may result in different performance outcomes. In this way, process feedback could be diagnostic in nature (Jacoby et al., 1984), thereby providing predictive and explanatory value. Future research on the differential effects of process and outcome feedback should include a process feedback manipulation that provides information based on the actual processes used by the individual.

Future researchers could also include other dimensions of feedback in evaluating the effectiveness of outcome versus process feedback and internal versus external feedback, such as sign, frequency, and timing. For example, the effects of outcome feedback may differ across feedback sign. Positive outcome feedback may be more detrimental than negative outcome feedback because it may cue that there is no need for additional information, thus interrupting the search for task-relevant cues and strategy development, even more than for negative outcome feedback, which at least indicates

actual performance is below the desired standard. Varying process and outcome feedback and internal and external feedback across other feedback dimensions could enhance our understanding of how these types of feedback operate to affect performance.

Finally, the findings of this study only apply to initial skill acquisition of a novel task. Thus, the effects of outcome, process, external and task feedback may not generalize to long-term learning effects. Generalization of these findings to retention and transfer can result in erroneous conclusions. Future research needs to assess the influence of feedback interventions on longer-term performance and performance under conditions that differ from the practice period (e.g., transfer design).

Theoretical Implications

Establishing a link between feedback types and feedback propensities during initial skill acquisition is a new direction for theorizing and research on the effects of feedback on performance. This study integrates the prior cognitive research on process and outcome feedback with the newer stream of research on feedback propensities as an individual difference in the feedback process. Integrating these two areas of research allows for exploration of differential effects of feedback types while assessing individual difference factors. Recently, researchers have called for a more active representation of the feedback recipient (e.g., Herold & Parsons, 1985). Instead of viewing the recipient as a passive receiver of feedback, we need to look at how individual differences interact with different types of feedback to influence performance. Future research on feedback propensities can extend out knowledge of individual differences that are specific to the feedback context.

This study also extends knowledge on the effects of external feedback by evaluating two types of external feedback, outcome, and process. Some researchers (e.g., Goodman, 1998; Salmoni et al., 1984) indicated that external feedback might actually debilitate performance by acting as crutch or sending contradictory messages to the performer. This study assesses external feedback compared to task feedback but attempts to detect differences of effects of two types of external feedback. Thus, findings from this study suggest that the provision of external feedback, in general, may not debilitate performance, but it is the absence of task feedback that may lead to performance impairment. In addition, by evaluating differences of performance outcomes between process and outcome feedback, this study adds to current literature on process and outcome feedback. Most researchers on the effects of process and outcome feedback have focused on multiple cue probability, decision-making, and negotiation tasks. This study evaluates the effects of process and outcome feedback using a different type of task commonly used in this stream of research.

By testing the effects of feedback propensities, this study adds to knowledge about the external and internal feedback propensity constructs. A relatively small stream of research has focused on feedback propensities. Thus, this study not only evaluates the influence of feedback propensity on performance, but also integrates the construct into a different context that varies several types of feedback. In addition, the findings from this study suggest that prior methods for measuring external and internal feedback propensity may not be appropriate for all task conditions that may involve alternative feedback sources (e.g., computer-mediated). Therefore, it is unclear whether the application of the feedback propensity constructs are useful in only certain task environments.

Practical Implications

From a more practical perspective, the findings from this study can help evaluate the effectiveness of different types of feedback. Because computerized training and feedback is becoming more prevalent, this study assessed the effectiveness of feedback type on skill acquisition on a novel task. Organizations use outcome feedback more often than process feedback (e.g., "You met your sales goal this week") because it seems more efficient and less ambiguous. However, providing outcome feedback may actually hurt performance levels. In addition, findings from this study suggest that performance seriously impaired when individuals are not provided with task feedback. Individuals must be able, to some extent, to monitor their own performance, detect and correct errors, and develop strategies.

Organizations spend tremendous amounts of money on training. Therefore, making such training effective, and understanding the influence of different training modes for different people is important. With further understanding of how individual differences enter into the training situation, we may design training programs with options for different amounts and types of feedback, make feedback contingent on feedback seeking, or otherwise move to optimize the match between feedback proclivities of the performer and the feedback environment. Further understanding of how individual differences influence the feedback process allows for interventions that can anticipate and alleviate subsequent training and performance problems.

Conclusion

Overall, the current study has demonstrated support for the proposition that feedback does not consistently improve performance. Instead, these findings show that

feedback has highly variable effects on performance. Task feedback improved performance, process feedback did not affect performance, and outcome feedback seemed to debilitate performance over time. (Note: There were no significant negative main effects of outcome feedback.) Feedback types differing only in message content (all feedback was veridical and presented on a computer screen) can have varying, even conflicting, effects on performance. Thus, it is important to understand what types of feedback are effective in different task environments. Moreover, the combination of feedback may not improve performance if certain types of feedback information are not provided. Earley et al. (1990) suggested that outcome and process feedback have an additive effect on performance when task feedback is present. However, results from the current study show that the combination of outcome and process feedback had no beneficial effects on performance without the inclusion of task feedback. Furthermore, the addition of outcome and process feedback did not significantly improve performance over task feedback alone.

Understanding the influence of different feedback types and feedback propensities on performance in initial skill acquisition expands our knowledge of the processes involved in how feedback affects performance. The current study contributes to feedback literature by assessing how different types of feedback affect performance by considering process, outcome, and task feedback types. It combines two streams of research on the efficacy of external feedback versus task feedback and the effectiveness of outcome feedback versus process feedback, thus extending our knowledge of the differential effects of feedback type. In addition, the study includes an individual difference factor specific to the feedback situation, feedback propensity, and examines its interaction with

feedback type. In the past, feedback literature has neglected to assess adequately individual difference variables when attempting to understand the nature of the feedback process. Inclusion of individual difference factors follows a recent call for a more active view of the feedback recipient and explores the role of individual characteristics that might influence the generation, processing, and reaction to performance feedback. Evaluation of these factors in relation to performance can help deepen our understanding of how the feedback process influences performance and what factors organizations need to consider when designing effective training programs.

Appendix A

Internal and External Propensity Scales (Herold & colleagues)
Internal Feedback Propensity

Please read each of the following statements. Rate the extent to which you agree or disagree with each statement. Even if you are unsure of an item, please answer it anyway.

1	2	3	4	5
Strongly disagree				Strongly agree

1. As long as I think that I have done something well, I am not too concerned about how other people think I have done.
2. How other people view my work is not as important as how I view my own work.
3. If you think you have done something well, do not let other people's opinions to the contrary get you down.
4. People ought to be more concerned with their self-image than with what other people think of them.
5. What I think of my work and myself is more important to me than what others think.
6. It is usually better not to put much faith in what others say about your work, regardless of whether it is complementary or not.

External Feedback Propensity

1. It is very important to me to know what people think of my work.
2. It is a good idea to get someone to check on your work before it is too late to make changes.
3. I like getting frequent feedback from other concerning my performance.
4. Even though I may think I have done a good job, it is best to listen to the feedback provided by others.
5. Since one cannot be objective about their own performance, it is best to listen to the feedback provided by others.
6. Even when I think that I could have done something better, I feel good when other people think well of what I have done.

Appendix B

Feedback Measure

Please read each of the following statements. Rate the extent to which you agree or disagree with each statement. Even if you are unsure of an item, please answer it anyway.

1	2	3	4	5
Strongly disagree				Strongly agree

1. The information provided to me during the task was useful for learning this task.
2. I felt the information provided to me during the task was helped me perform the task better.
3. It would have been more difficult to perform this task without the information provided during the task.
4. Information provided to me during the task was accurate.
5. The information provided to me during the task was necessary to perform this task well.
6. The feedback I received was consistent.
7. The feedback I received was reliable.
8. I trust the feedback I received.
9. I placed a lot of faith in the performance feedback that was provided to me.

Appendix C

Goal Orientation Trait Measure (Vandewalle, 1997)

Please read each of the following statements. Rate the extent to which you agree or disagree with each statement. Even if you are unsure of an item, please answer it anyway.

1	2	3	4	5	6
Strongly disagree					Strongly agree

1. I am willing to select a challenging work assignment that I can learn a lot from.[a]
2. I often look for opportunities to develop new skills and knowledge.[a]
3. I enjoy challenging and difficult tasks at work where I'll learn new skills.[a]
4. For me, development of my work ability is important enough to take risks.[a]
5. I prefer to work in situations that require a high level of ability and talent.[a]
6. I'm concerned with showing that I can perform better than my coworkers.[b]
7. I try to figure out what it takes to prove my ability to others at work.[b]
8. I enjoy it when others at work are aware of how well I am doing.[b]
9. I prefer to work on projects where I can prove my ability to others.[b]
10. I would avoid taking on a new task if there was a chance I would appear rather incompetent to others.[c]
11. Avoiding a show of low ability is more important to me than learning a new skill.[c]
12. I am concerned about taking on a task at work if my performance would reveal I had low ability.[c]
13. I prefer to avoid situations at work where I might perform poorly.[c]

[a] Learning items: 1, 2, 3, 4, 5.
[b] Prove items: 6, 7, 8, 9.
[c] Avoidance items: 10, 11, 12, 13.

Appendix D

Locus of Control (Rotter, 1966)

Please read the following statements. Please choose the statement that best applies to you. Even if you are unsure of an item, please answer it anyway.

1. a. Children get into trouble because their patents punish them too much.
   b. The trouble with most children nowadays is that their parents are too easy with them.
2. a. Many of the unhappy things in people's lives are partly due to bad luck.
   b. People's misfortunes result from the mistakes they make.
3. a. One of the major reasons why we have wars is because people do not take enough interest in politics.
   b. There will always be wars, no matter how hard people try to prevent them.
4. a. In the long run people get the respect they deserve in this world
   b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries
5. a. The idea that teachers are unfair to students is nonsense.
   b. Most students do not realize the extent to which their grades are influenced by accidental happenings.
6. a. Without the right breaks, one cannot be an effective leader.
   b. Capable people who fail to become leaders hive not taken advantage of their opportunities.
7. a. No matter how hard you try, some people just do not like you.
   b. People who cannot get others to like them do not understand how to get along with others.
8. a. Heredity plays the major role in determining one's personality
   b. It is one's experiences in life which determine what they are like.
9. a. I have often found that what is going to happen will happen.
   b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.
10. a. In the case of the well-prepared student there is rarely if ever such a thing as an unfair test.
    b. Many times exam questions tend to be so unrelated to course work that studying in really useless.
11. a. Becoming a success is a matter of hard work; luck has little or nothing to do with it.
    b. Getting a good job depends mainly on being in the right place at the. right time.
12. a. The average citizen can have an influence in government decisions.
    b. This world is run by the few people in power, and there is not much the little guy can do about it.
13. a. When I make plans, I am almost certain that I can make them work.
    b. It is not always wise to plan too far ahead because many things turn out to- be a matter of good or bad fortune anyhow.

14. a. There are certain people who are just no good.
    b. There is some good in everybody.

15. a. In my case, getting what I want has little or nothing to do with luck.
    b. Many times, we might just as well decide what to do by flipping a coin.

16. a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.
    b. Getting people to do the right thing depends upon ability; luck has little or nothing to do with it.
17. a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.
    b. By taking an active part in political and social affairs, the people can control world events.
18. a. Most people do not realize the extent to which their lives are controlled by accidental happenings.
    b. There really is no such thing as "luck."
19. a. One should always be willing to admit mistakes.
    b. It is usually best to cover up one's mistakes.
20. a. It is hard to know whether or not a person really likes you.
    b. How many friends you have depends upon how nice a person you are.
21. a. In the long run the bad things that happen to us are balanced by the good ones.
    b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
22. a. With enough effort, we can wipe out political corruption.
    b. It is difficult for people to have much control over the things politicians do in office.
23. a. Sometimes I cannot understand how teachers arrive at the grades they give.
    b. There is a direct connection between how hard I study and the grades I get.
24. a. A good leader expects people to decide for themselves what they should do.
    b. A good leader makes it clear to everybody what their jobs are.
25. a. Many times, I feel that I have little influence over the things that happen to me.
    b. It is impossible for me to believe that chance or luck plays an important role in my life.
26. a. People are lonely because they do not try to be friendly.
    b. There is not much use in trying too hard to please people, if they like you, they like you.
27. a. There is too much emphasis on athletics in high school.
    b. Team sports are an excellent way to build character.
28. a. What happens to me is my own doing.
    b. Sometimes I feel that I do not have enough control over the direction my life is taking.
29. a. Most of the time I cannot understand why politicians behave the way they do.
    b. In the long run, the people are responsible for bad government on a national as well as on a local level.

Appendix E

Coopersmith (1975) Self-esteem measure

Please read each of the following statements. Rate the extent to which you think the statement is like you. Even if you are unsure of an item, please answer it anyway.

1	2	3	4	5	6
Very unlike me					Very like me

1. I often wish I were someone else.
2. I find it very hard to talk in front of a group.
3. There are lots of things about myself I'd change if I could.
4. I can make up my mind without too much trouble.*
5. I'm a lot of fun to be with.*
6. I get upset easily at home
7. It takes me a long time to get used to anything new.
8. I'm popular with people my own age.*
9. My family expects too much of me.
10. I give in very easily.
11. My family usually considers my feelings.*
12. It's pretty tough to be me.
13. Things are all mixed up in my life.
14. Other people usually follow my ideas.*
15. I have a low opinion of myself.
16. There are many times when I'd like to leave home.
17. I often feel upset about the work I do.
18. I'm not as nice looking as other people.
19. If I have something to say, I usually say it.*
20. My family understands me.*
21. Most people are better liked than I am.
22. I usually feel as if my family is pushing me.
23. I often get discouraged at what I am doing.
24. Things usually don't bother me.*
25. I can't be depended on.

* Reverse scored items: 4, 5, 8, 11, 14, 19, 20, 21

Note: Higher scores denote lower self-esteem.

Appendix F

Self-Consciousness Scale (Sheier & Carver, 1985)

Please read each of the following statements. Rate the extent to which you think the statement is like you. Even if you are unsure of an item, please answer it anyway.

0	1	2	3
Not at like me	A little like me	Somewhat like me	A lot like me

1. I am always trying to figure myself out.[a]
2. I think about myself a lot.[a]
3. I often daydream about myself.[a]
4. I never take a hard look at myself.[a*]
5. I generally pay attention to my inner feelings.[a]
6. I am constantly thinking about my reasons for doing things.[a]
7. I sometimes step back (in my mind) in order to examine myself from a distance.[a]
8. I am quick to notice changes in my mood.[a]
9. I know the way my mind works when I work through a problem.[a]
10. It is easy for me to talk to strangers.[c*]
11. I am concerned about my style of doing things.[b]
12. I am concerned about the way I present myself to others.[b]
13. I am self-conscious about the way I look.[b]
14. I usually worry about making a good impression.[b]
15. Before I leave my house, I check how I look.[b]
16. I am concerned about what other people think of me.[b]
17. I am usually aware of my appearance.[b]
18. It takes me time to get over my shyness in new situations.[c]
19. It is hard for me to work when someone is watching me.[c]
20. I get embarrassed very easily.[c]
21. I feel nervous when I speak in front of a large group.[c]
22. Large groups make me nervous.[c]

* Reverse-scored items: 4, 10
[a] Private self-consciousness items: 1, 2, 3, 4, 5, 6, 7, 8, 9.
[b] Public self-consciousness items: 11, 12, 13, 14, 15, 16, 17.
[c] Social anxiety items: 10, 18, 19, 20, 21, 22.

Appendix G

Self-Efficacy Scale

Please read each of the following statements. Rate the extent to which you agree or disagree with each statement. Even if you are unsure of an item, please answer it anyway.

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

1. I have confidence in my ability to perform this task.
2. There are some activities required by this task that I cannot do well.*
3. When my performance is poor, it is due to my lack of ability.*
4. I doubt my ability to perform this task.*
5. I have all the skills needed to perform this task very well.*
6. Most students can do this task better than I can.
8. My future success in this task is limited due to my lack of skills.
9. I am very proud of my skills and abilities on this task.
10. I feel threatened when others watch me work.

Appendix H

Intrinsic Motivation

Please read each of the following statements. Rate the extent to which you agree or disagree with each statement. Even if you are unsure of an item, please answer it anyway.

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

1. I enjoy performing this task very much.[a]
2. I think I am pretty good at this task.[b]
3. I put a lot of effort into this task.[c]
4. I do not feel nervous at all while performing this task.[d]
5. This task is fun to do.[a]
6. I think I do pretty well at this task, compared to other students.[b]
7. I haven't tried very hard to do well on this task.[c*]
8. I feel very tense while performing this task.[d*]
9. I haven't really had a choice about performing this task.[e*]
10. I think this task is boring.[a*]
11. I try very hard in performing this task.[c]
12. I am very relaxed in performing the actions required for this task.[d]
13. I feel like I have to perform this task.[e*]
14. This task does not hold my attention at all.[a*]
15. I would describe this task as very interesting.a
16. I am pretty skilled at the level of difficulty presented in this task.[b]
17. I haven't put very much energy into this task.[c*]
18. I feel pressured during performance of this task.[d*]
19. I think this task is quite enjoyable.[a]
20. While performing this task, I think about how much I enjoy problem-solving.[a]
21. I perform this task because I have no other choice.[e*]

* Reverse-scored items: 7, 8, 9, 10, 13, 14, 17, 18, 21.
[a] Intrinsic enjoyment items: 1, 5, 10, 14, 17, 18, 21.
[b] Perceived competence items: 2, 6, 16.
[c] Effort-importance items: 3, 7, 11, 17
[d] Tension-pressure items (high scores reflect low tension-pressure): 4, 8, 12, 18.
[e] Choice items: 9, 13, 21.
Higher scores denote higher intrinsic motivation. Scores for each subscale are equal to the average score for all subscale items.

Appendix I

Subjective Task Complexity

These questions ask you about your feelings regarding the task you just performed, as well as previous experience with similar tasks. Please read each of the following statements. Even if you are unsure of an item, please answer it anyway.

1	2	3	4	5	6	7
Not At all						Very

1. How complex did you find this task?
2. How mentally demanding was this task?
3. To what extent did this task require a lot of thought and problem-solving?
4. How challenging did you find this task to be?
5. How difficult was this task to perform?
6. How easy was this task to understand?*
7. How simple did you find this task?*
8. How difficult were the rules for performing this task?
9. To what extent could you work on this task and think of other problems at the same time?*
10. To what extent did you understand all the rules for performing this task?*

* Reverse-scored items: 6, 7, 9, 10

Appendix J

Demographic Information

1. Sex: a) Male b) Female

2. Age: a) 18 and under b) 19 c) 20 d) 21 e) 22
   f) 23 g) 24 h) 25 and over

3. College Ranking: a) Freshman b) Sophomore c) Junior d) Senior

4. College Major: a) Business b) Communications c) Computers
   e) Engineering f) Mathematics g) Psychology
   h) Sociology i) Other

5. Overall College GPA: a) 0.0-0.5 b) 0.6-1.0 c) 1.1-1.5 d) 1.6-2.0
   e) 2.1-2.5 f) 2.6-3.0 g) 3.1-3.5 h) 3.6-4.0
   i) No GPA

Appendix K

CONSENT TO PARTICIPATE
DEPARTMENT OF PSYCHOLOGY
WRIGHT STATE UNIVERSITY
DAYTON, OHIO 45435

Title of Study Performance on a computerized problem-solving task .

Purpose I understand that the purpose of this study is to explore several aspects of performance while engaged in a computerized problem-solving task.

Activities I understand that during this experiment I will play multiple trials of a computer task based on the board game, MasterMind. The game involves guessing which colored pegs belong in each of several holes. Feedback will be provided to help my teammate and me guess the "code". I will be given a specific set of instructions to follow, and I will be asked to answer survey questions about the task, and my individual appraisal of the task. The study will take about 2 hours. I understand that I will be provided with appropriate breaks between trials.

Risks/Benefits I understand that there is minimal risk and discomfort anticipated as part of or as a result of this experiment. The primary risk is fatigue resulting from trying to guess the "codes." Although an injury is extremely unlikely, I understand that only emergency medical treatment is available if a research-related injury occurs. I understand I will be provided with appropriate breaks between trials. I understand there are no direct benefits to me, but I will get some experience in how psychological studies are conducted and satisfaction of assisting the advancement of science and helping graduate students with their research. I understand the task and all surveys will be conducted on the computer. However, only the authorized experimenters will have access to data collected on computers in order to keep data strictly confidential.

Compensation In exchange for my participation, I understand that I will receive 1 extra credit point for each half-hour of participation or part thereof, for a maximum of 4 points.

Confidentiality I understand that any information about me obtained from this study will be kept strictly confidential and that I will not be identified in any report or publication.

Freedom to Withdraw I realize that research participation is completely voluntary and that I am free to refuse to participate in this study or withdraw at any time. There is no penalty of any kind for either non-participation or withdrawal.

Availability of Results I understand that I may obtain a summary of these results by contacting the principal investigator (Kristin Delgado, 775-2391) after August 2005. The results will show only aggregated (i.e., combined) data for the entire sample. No individual results will be available.

Investigator Availability I understand that,if I have any questions or concerns, I can contact the principal investigator, Kristin Delgado or the faculty advisor, Debra Steele-Johnson, Ph.D., Associate Professor, Department of Psychology, 325B Fawcett (937 775-3527), or Wright State University's Department of Psychology (937 775-2391).

Consent My signature below indicates that I consent to participate in this research investigation.

_____ _____

Signed **Date**

_____

Name (Please Print Neatly)

_____ _____

Faculty Advisor (Debra Steele-Johnson) **Date**

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